Test Plan

ALWAYS HOMe

Team: Always Home

Project: Smart Door

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Document Revision History

Revision Number	Revision Date	Description	Rationale
1.0	03/19/2014	Presentation Draft	First draft submitted for initial review
2.0	04/01/2014	Baseline	Minor fixes through the document

1. Introduction

1.1. Product Purpose

The Smart Door will allow a homeowner to answer the door remotely. The doorbell will connect the homeowner and guest(s) via a call to the homeowner's smart phone. The homeowner will receive the call, and a snapshot of the guest through a mobile application. The homeowner will see this information, and will be able to decide if he or she wants to answer or ignore the call. The call will send the homeowner a video feed where he or she can interact with the guest(s). The mobile application will also allow the homeowner to lock or unlock the door while on and off a call. The mobile application will also receive notifications when the door is opened or closed. The Smart Door web application will store video interactions with guests, and will allow the homeowner to view and download the videos.

1.2.Product Scope

The goal of the Smart Door is to provide a system to facilitate, and improve interactions with visitors to one's home or business. The Smart Door offers real time notification when the door bell is rung, or the door is opened or closed. The system features two way audio and one way video from the door to the mobile application. The mobile application will allow the user to view a live feed of the door, and lock/unlock the door remotely. The system will include a web application that will contain a history of all the events the door records. The history will consist of a log of every time the door opens and closes with a timestamp, and a log of every door-to-mobile video interaction with a timestamp. The video log will allow the user to view, delete, and download the videos

1.3.Document Purpose

The System Test Plan (STP) is necessary to ensure product design and implementation meets the complete product as specified in the System Requirements Specification (SRS), and the Detail Design Specification (DDS). It will be used as a way to validate and verify our product solves the original problem given. This includes the Always Home team's requirements and those of our stakeholders.

1.4.Document Scope

The STP contains a detailed process for testing the Smart Door system on requirements verification, unit test, component test, hardware test, and acceptance test.

1.4.1.Requirements verification

Ensures that the product is complete and built right with respect to the teams and stakeholders requirements.

1.4.2.Unit test

Ensures that the lowest level of modules work individually avoiding problems when integrating the modules.

1.4.3.Component Test

Ensures that all modules work together correctly in the subsystem level.

1.4.4. Integration test

Ensures that the combination of functions, modules, and subsystems function together to fulfill the business requirements.

1.4.5. Hardware verification

Ensures that the hardware systems function as expected individually and in conjunction with other hardware systems.

1.4.6. Acceptance test

Ensures that the system as a whole satisfies the requirements of the stakeholders.

2. References

2.1. Overview:

The References section of the System Test Plan provides relevant information to documents that were previously completed for our project. These documents are the System Requirements Specification (SRS), the Architecture Design Specification (ADS), and the Detailed Design Specification (DDS) documents. Each reference sub section provides detailed information required to conduct the test drive. More specifically, The SRS reference sub section contains customer requirements, packaging requirements, performance requirements, etc., system I/O that shall be used to determine verification tests. The ADS sub section contains data flows between layers which will be used to determine layer integration testing. The DDS subsection contains subsystem, modules and data flows, which will be used for unit testing.

2.2.System Requirement Specification:

2.2.1.Customer Requirements:

ID	Requirement	Description	Priority
3.1	Smartphone Application Control	The system shall be controlled by a smartphone application installed on the users' smartphone, providing a means for the users to interact with the system.	1 – Critical
3.2	Snapshot of Guests at Door	Photo images shall be taken and stored by the system when doorbell is rung.	1 – Critical
3.3	Keep Activities Log	The systems activity log shall differentiate between users when logging all interactions and activities of the system.	1 – Critical
3.4	Emergency Power Supply	The system shall have an emergency power supply.	4 – Low
3.5	Video Monitoring	The system shall allow registered users to monitor activities via live video feed on smart phones.	2 – High
3.6	System Portability	The system shall be a portable device that the customer can take with them when they move.	2 – High
3.7	Smart Phone Pairing	The system shall pair user activity with a particular smartphone to keep logs of who interacts with the system.	2 – High
3.8	Motion Sensor	The system shall have a short-range motion sensor. The motion sensor will take a picture and upload it to the server every time the sensor is triggered.	5 – Future
3.9	Local Storage	The device shall have an on-board storage device.	2 – high
3.10	Hardware Security	The device shall be enclosed in a secured case.	2 – High
3.11	Z-Wave	The system shall be compatible with Z-Wave wireless communications protocol.	5 – Future
3.12	Lock/Unlock	The system shall be able to lock and unlock the door remotely.	5 – Future
3.13	Open Source	The source code of the system shall be released under an open source license.	1 – Critical.
3.14	Nonintrusive	The system shall not interfere with normal functionalities and operations of the existing door and doorbell.	1 - Critical
3.15	Account Setup	The system shall provide account setup capability. The account setup will be responsible for pairing a phone to a particular Smart Door device.	2 – High
3.16	Video Log Downloads	The system shall allow registered users to download videos from the video log on the website interface.	4 – Low

Table 1: Customer Requirements

2.2.2. Packaging Requirements:

ID	Requirement	Description	Priority
4.1	Size	The system shall be enclosed in a box that is no larger than 12x12x4 (576 cubic in). This size will optimize volume while ensuring adequate space is still available for components, connections, and heat dissipation.	1 – Critical
4.2	Temperature Control	The enclosure shall provide ventilation for heat removal.	3 – Moderate
4.3	Mounting	The product shall provide mounting brackets and screws for secure attachment of the system. The portion of the system containing the camera shall be mounted within 2 feet of the door.	1 – Critical
4.4	Casing	The system shall be enclosed in a case that shall keep its internal components secure.	2 – High
4.5	Software Acquisition	The system software shall be available on the Internet. Software for the PC/hardware interface shall be packaged with the product on a CD.	1 – Critical
4.6	Included Components	The product will be delivered to the end-user with the Always Home device, user manual, and mounting hardware.	2 – High
4.7	Team Logo	The logo will be visibly displayed on the base of the final product.	4 – Low
4.8	System Configuration	The system's camera, doorbell, and microphone shall be collocated in a common enclosure.	1 - Critical

Table 2: Packaging Requirements

2.2.3.Performance Requirements:

ID	Requirement	Description	Priority
5.1	System Setup	The system shall be able to be mounted and configured in less than ten minutes by the end user. The user will mount the hardware near the door, and the configuration shall be defined as pairing the user's mobile device with the hardware.	3 – Moderate
5.2	Notification Time	While the system is operational and connected to the internet, the system shall notify the user of guest activity in less than 30 seconds.	2 – High
5.3	Latency	The user shall have an overall user request latency of less than 10 seconds. Overall latency includes the transmission of the user request and system response time.	2 – High
5.4	Response Time	While the system is operating within the Active state, the system shall respond to user requests in less than 7 seconds.	2 – High
5.5	Data Transmission – Live Video Feed	The system shall transmit video at 30 frames per second at a minimum resolution specified in requirement 5.16.	2 – High
5.6	Data Transmission – Audio Transmission	The system shall transmit audio at a minimum of 800 bits per second.	2 – High
5.7	Recording Log – Log Availability	The logs shall be updated at least 5 minutes after interaction has ended.	3 – Moderate
5.8	Recording Log – Storage Capacity	The system shall provide at least 32GB of storage capacity for videos.	3 – Moderate
5.9	Power – Power Supply	The system shall be equipped with a power supply that will take a power source as specified in requirement 5.10 and provide an operating voltage of 1-15V and a current less than 20A.	1 – Critical
5.10	Power – Power Source	The system shall source 120VAC power from a standard household electrical outlet.	1 – Critical
5.11	Emergency Backup Battery	The system shall provide an emergency backup battery that allows it to operate for at least eight hours.	5 – Future Item
5.12	I/O Ports	The system shall provide the appropriate I/O ports for interacting with components, including, but not limited to: General Purpose I/O ports, USB ports, and TRS phone jacks.	2 – High
5.13	Operating Environment	The system shall remain operational within humidity ranges from 0% - 95%,	2 – High

		and temperature ranges from -12°C - 70°C.	
5.14	Video/Photo Resolution	The system shall have recording capability for photo and video resolution of at least 352x240 pixels.	2 – High
5.15	System Availability	After initial configuration, the system shall be available at least 95% of the time that it is connected to both working 120VAC electrical power and a working internet connection.	2 – High
5.16	Notification Limit	The system shall notify the user of doorbell rings a maximum of 3 times in a 2-minute period where rings will be processed every 30 seconds.	5 – Future Item
5.17	Initialization Time	Upon device power on, the system shall be initialized after a period no longer than 5 minutes.	1 – Critical
5.18	Mounting Height	The system's user manual shall specify that the portion of the system containing the video camera be mounted within a height range of 60 – 66 inches.	1 – Critical
5.19	Microphone Sensitivity	The system shall provide a microphone with at least -20db sensitivity to reduce ambient noise processing.	2 – High

Table 3: Performance Requirements

2.2.4.Safety Requirements:

ID	Requirement	Description	Priority
6.1	Camera Mounting	The camera shall be secured properly to prevent a fall or collision hazard. The camera's mounting base must be properly secured to the door and positioned at the correct height for use.	3 – Moderate
6.2	Microphone Mounting	The microphone shall be secured properly to prevent a fall or collision hazard. The microphone's mounting base must be properly secured to a structure and positioned four or more vertical feet off the ground.	3 – Moderate
6.3	Camera and Microphone Weather Safety	The camera and microphone shall be installed in a manner that is considered to be weather safe.	1 – Critical
6.4	Receptacles	All electric receptacles shall meet the National Electrical Code for outdoor wiring.	5- Future Item

Table 4: Safety Requirements

2.2.5.Maintenance and Support Requirements:

ID	Requirement	Description	Priority
7.1	Software Updates	Software updates shall be available from the internet.	5- Future Item
7.2	User Manual	The system shall provide English instructions on how to use and configure the device. There shall be a troubleshooting guide section for system installer.	3 – Moderate
7.3	Open Source	All documents and source code shall be made available without financial remuneration. Code shall be commented and include breakpoints to support troubleshooting.	1 – Critical

Table 5: Maintenance Requirements

2.2.6.Other Requirements:

ID	Requirement	Description	Priority
8.1	Web Interface Support	The system shall include a web application that provides the same capabilities for controlling and interacting with the system as the smartphone application.	1 – Critical
8.2	Portable Source Code	The system shall include an iOS application that provides the same capabilities for controlling and interacting with the system as the smartphone application.	5 – Future Item
8.3	Notification Control	The system shall not notify the customer again for at least two minutes if the user chooses to ignore the first notification.	2 – High

Table 6: Other Requirements

2.3.Architecture Design Specification:

2.3.1.Architecture Layer Diagram:

Always Home will be divided into four major layers: the UI Layer, Processing Layer, Networking Layer, and Data Storage Layer. The architecture of it is based on an extended three tier-architecture. The layer structure is shown below.

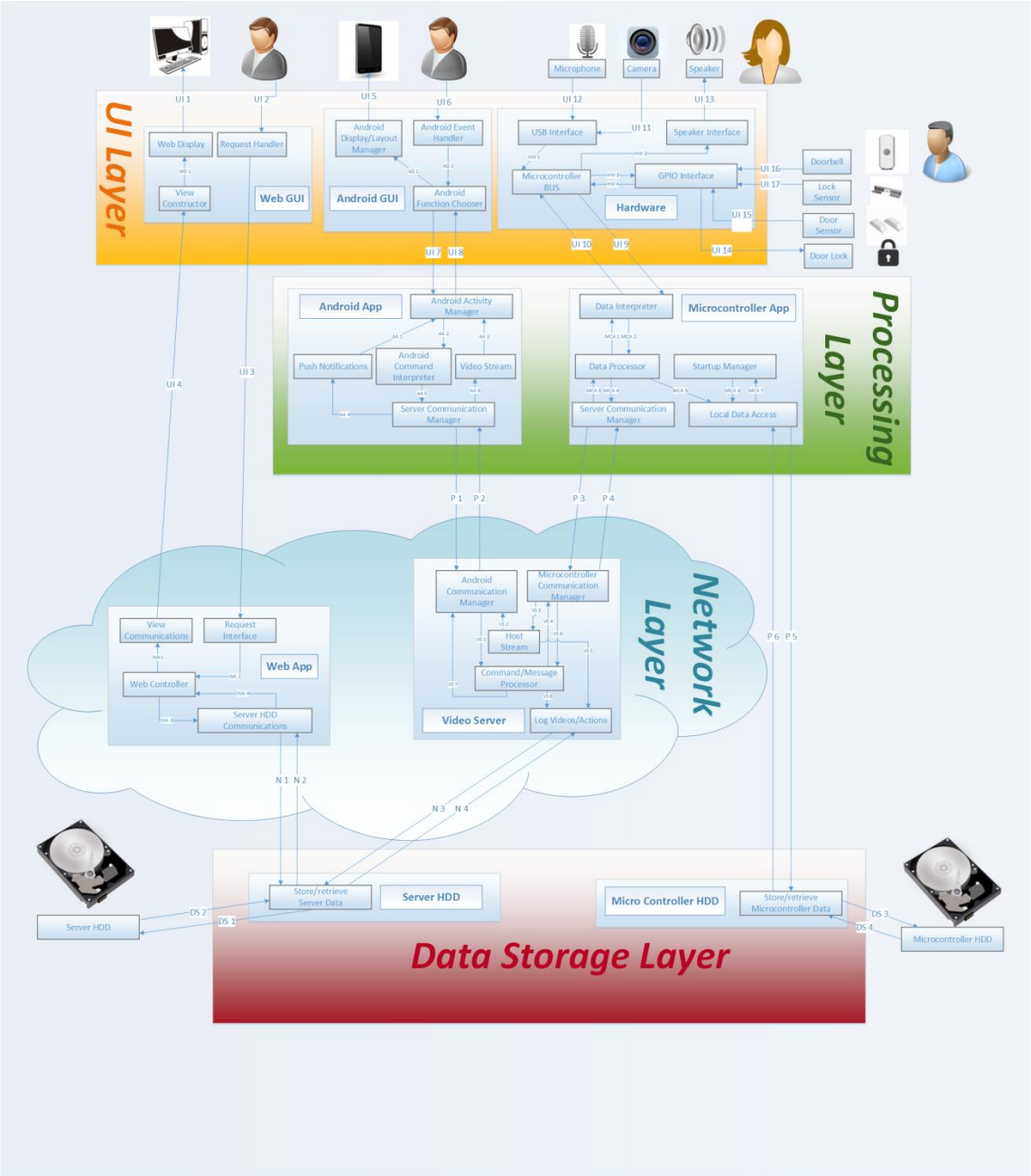

Figure 1: Layer Diagram

2.3.2.Layer Description:

2.3.2.1. UI Layer – Hardware I/O:

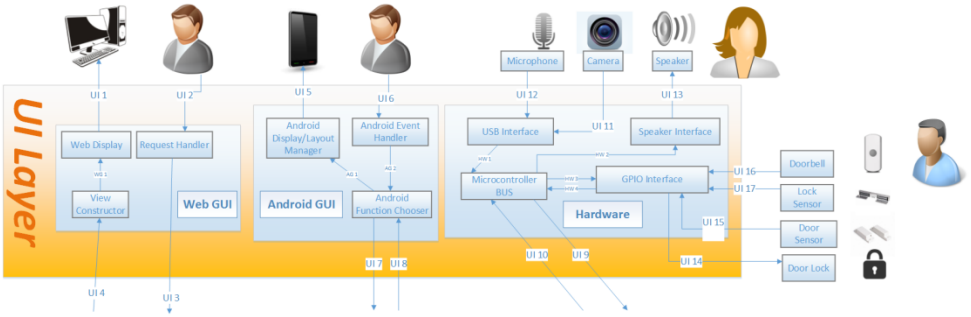

Figure 2: UI Layer

The UI layer receives input from the user through our software interface the Web GUI and Android GUI. It also receives input from the user through our hardware such as the doorbell, camera, and microphone. This layer will be responsible for transmitting input to other layers as well as displaying results from other layers. This will include transmitting audio and video into meaningful values to properly stream video. This layer will utilize our three different interfaces: the hardware, the web, and mobile device.

2.3.2.2. Processing Layer:

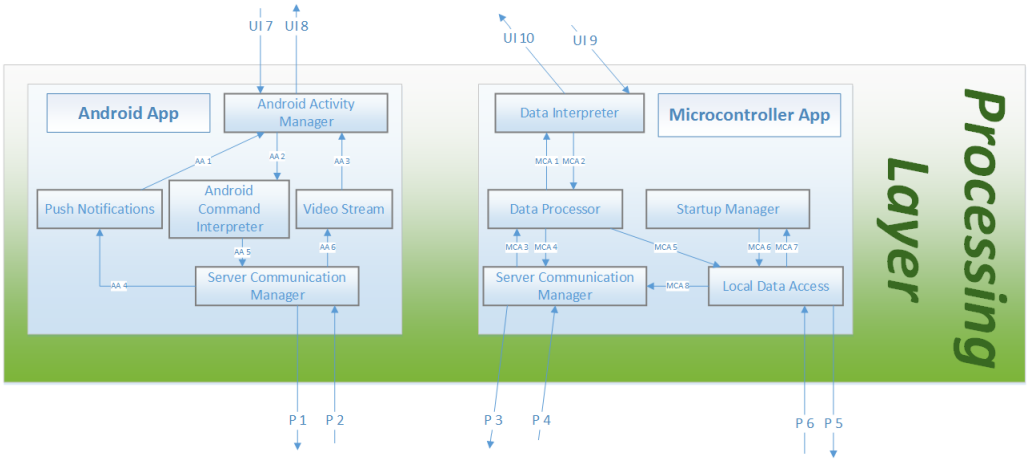

Figure 3: Processing Layer

The Processing Layer will focus on converting and evaluating our data. It will perform task to take the input from the GUIs and Hardware and convert the data to information that can be transferred to other components in our system. It will have to be able to take data and prepare it for output.

2.3.2.3. Network Layer:

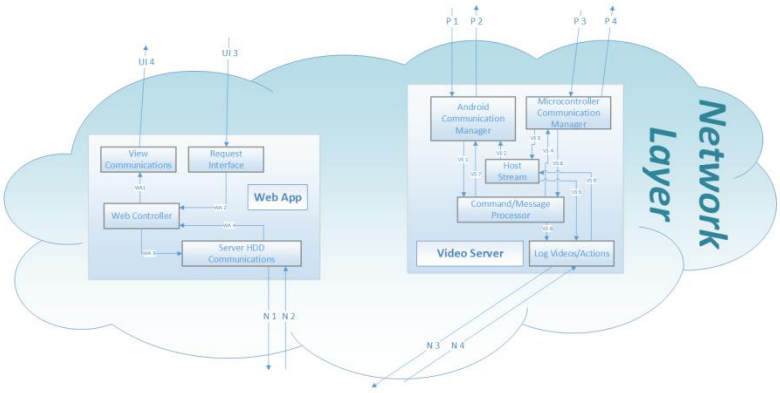

Figure 4: Network Layer

The Network Layer will focus on converting and evaluating our data in terms of information from mobile, website, and microcontroller. It also serves a way to process data from storage to meaningful information. It will perform the task of processing the different types of data from our different interface into a uniform data that can be used by other components in our system. This is the backbone of our system that will handle the bulk of the processing.

2.3.2.4. Data Storage Layer:

Figure 5: Data Storage Layer

The Data Storage Layer will store information either locally or remotely on a server. This is where the information will be held until it needs to be access. This is where the storage of the videos will be for user to see past ones and live ones.

2.4.Detailed Design Specification:

2.4.1.Subsystem Decomposition:

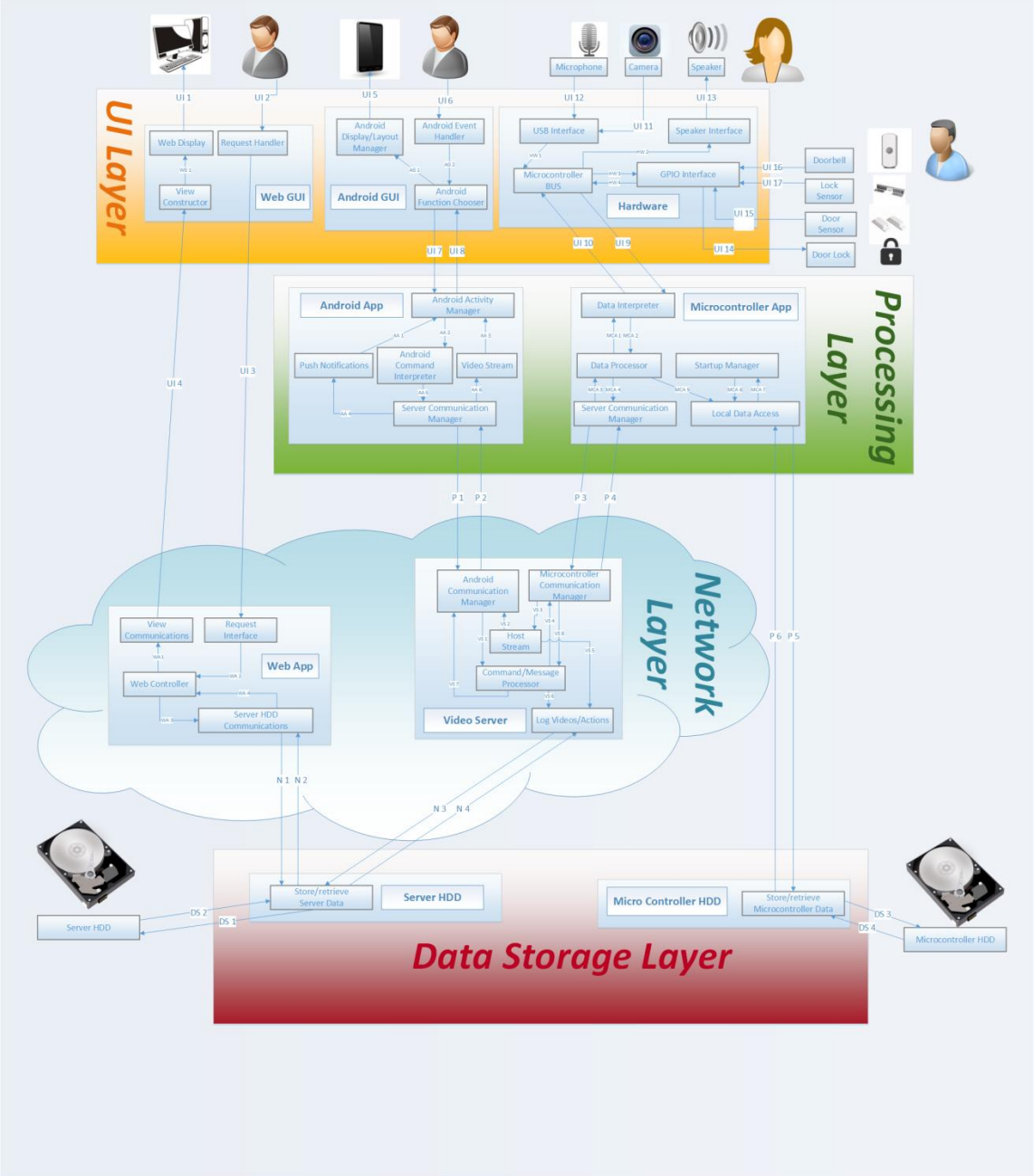

Figure 6: Subsystem Decomposition

2.5.Data Element Description:

System Level Data Element Description	
Data Element	**Description**
UI 1	Webpages displayed on users Monitor from Web GUI
UI 2	User Input into Web GUI
UI 3	User Input passed to Web App from Web GUI
UI 4	Webpages and messages to be displayed by Web GUI from Web App
UI 5	Interactions displayed on users Android Device
UI 6	User Input into Android App
UI 7	User Input passed to Android App from Android GUI
UI 8	Interactions to be displayed by the Android GUI form the Android App
UI 9	Raw Data from the Hardware being passed to the Microcontroller App
UI 10	Audio Data and Lock/Unlock commands from Microcontroller App to the Hardware
UI 11	Raw Data from Camera to the Hardware Subsystem
UI 12	Raw Data from Microphone to the Hardware Subsystem
UI 13	Audio Stream from Hardware to User at the Door
UI 14	Lock/Unlock Signal from Hardware Subsystem to the Door Lock
UI 15	Raw Data from Door Sensor to the Hardware Subsystem
UI 16	Raw Data from Doorbell to the Hardware Subsystem
UI 17	Raw Data from Door Lock to the Hardware Subsystem
P 1	Information Requests and Commands from Android App to Video Server
P 2	Video/Audio Streams, and Sensor Information from Video Server to Android App
P 3	Video/Audio Streams, and Sensor Information from Microcontroller App to Video Server
P 4	Information Requests and Commands from Video Server to Microcontroller App
P 5	Recorded Notifications and MPG4 Files from Microcontroller App to Microcontroller HDD
P 6	Recorded Notifications and MPG4 Files from Microcontroller HDD to Microcontroller App
N 1	Information Requests from Web App to Server HDD
N 2	Recorded Notifications and MPG4 Files from Microcontroller HDD to Microcontroller App
N 3	Information Requests and MPG4 Files from Video Server to Server HDD
N 4	Recorded Notifications and MPG4 Files from Microcontroller HDD to Microcontroller App
DS 1	Recorded Notifications and MPG4 Files from Server HDD Subsystem to Physical HDD
DS 2	Recorded Notifications and MPG4 Files from Physical HDD to Server HDD Subsystem
DS 3	Recorded Notifications and MPG4 Files from Microcontroller HDD Subsystem to Physical HDD
DS 4	Recorded Notifications and MPG4 Files from Physical HDD to Microcontroller HDD Subsystem

Table 7: Data Element Description

2.6.Producer/Consumer Matrices

2.6.1. System Level Producer Consumer Matrix

Producer/Consumer Table

Consumer \ Producer	Hardware	Web GUI	Android GUI	Microcontroller App	Android App	Web App	Video Server	Microcontroller HDD	Server HDD	EXTERNAL
Hardware				UI 10						UI 11, UI 12, UI 15, UI 16, UI 17
Web GUI					UI 4					UI 2
Android GUI					UI 8					UI 6
Microcontroller App	UI 9						P 4	P 6		
Android App		UI 3	UI 7				P 2			
Web App									N 2	
Video Server				P 3	P 1				N 4	
Microcontroller HDD					P 5					DS 4
Server HDD						N 1	N 3			DS 2
External	UI 13, UI 14	UI 1	UI 5					DS 3	DS 1	

Table 8: System Level Producer Consumer Table

2.6.2. Web Producer Consumer Matrix

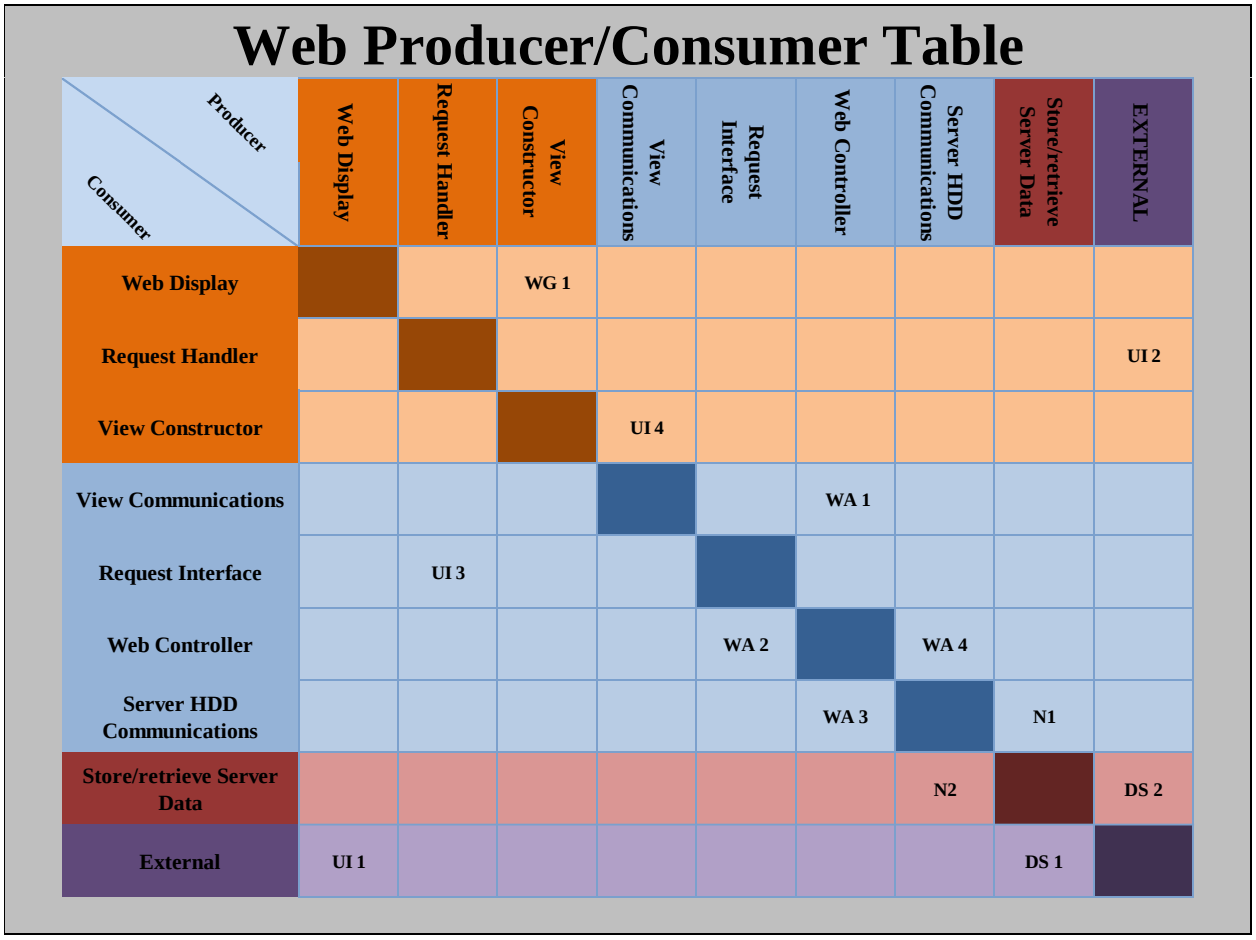

Table 9: Web Producer Consumer Table

2.6.3. :Android Producer Consumer Matrix

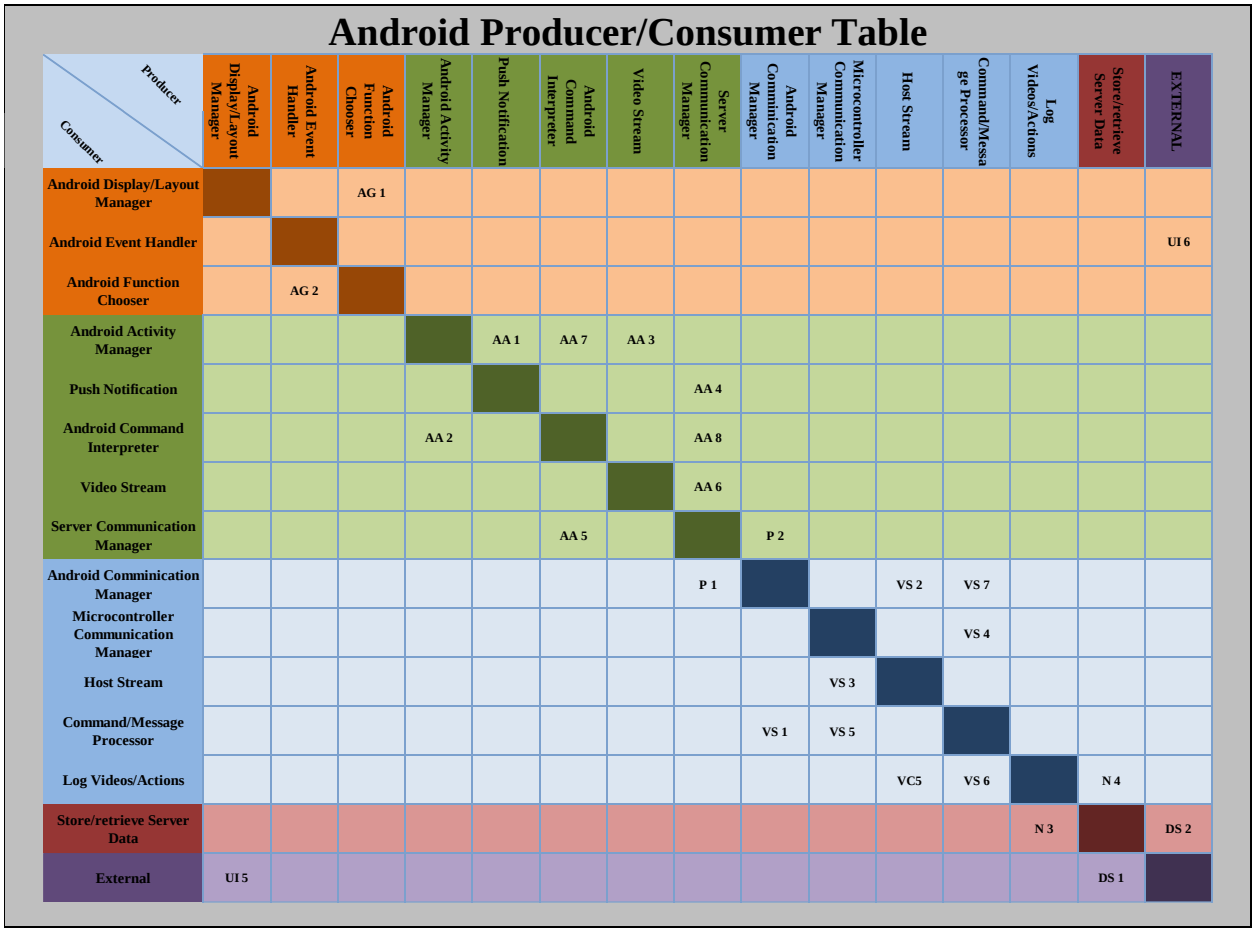

Table 10: Android Producer Consumer Table

2.6.4. Hardware Producer Consumer Matrix

Hardware Producer/Consumer Table

Consumer \ Producer	USB Interface	Microcontroller BUS	Speaker Interface	GPIO Interface	Data Interpreter	Data Procesor	Startup Manager	Server Communication Manager	Local Data Access	Android Communication Manager	Microcontroller Communication Manager	Host Stream	Command/Message Processor	Log Videos/Actions	Store/retrieve Server Data	Store/retrieve MicroController Data	EXTERNAL
USB Interface																	UI 11, UI 12
Microcontroller BUS	HW 1			HW 4	UI 10												
Speaker Interface		HW 2															
GPIO Interface		HW 3															UI 15, UI 16, UI 17
Data Interpreter		UI 9				MCA 1											
Data Procesor					MCA 2			MCA 3									
Startup Manager									MCA 7								
Server Communication Manager						MCA 4											
Local Data Access						MCA 5	MCA 6			P 4						P 6	
Android Communication Manager												VS 2	VS 7				
Microcontroller Communication Manager									P 3				VS 4				
Host Stream											VS 3						
Command/Message Processor										VS 1	VS 5						
Log Videos/Actions												VC5	VS 6		N 4		
Store/retrieve Server Data														N 3			DS 2
Store/retrieve MicroController Data									P 5								DS 4
External			UI 13	UI 14											DS 1	DS 3	

Table 11: Hardware Producer Consumer Table

3. Risks

3.1.Introduction

3.2.Risk Levels

Risk 1: High risk of test failure

Risk 2: Moderate risk of test failure

Risk 3: Low risk of test failure

Risk 4: Possibility of inconclusive test

Risk 5: Future implementation

3.3.Systemic risks

Risk 1 items from Integration tests

3.4.Specific Risks that affect testing

Risk 4 items are testing related risks, an inconclusive test does not inform the development team

Impact assessment and management plan as it relates to these risks (for each risk)
Should be a table summarizing the impact of EACH risk at ALL levels. Management plan for Risk 1 and Risk 4.

4. Test Items

4.1.Overview

This section will provide details on what will be delivered to the customer. These requirements will be based off our previous documentation.

- The test procedure will begin with testing the hardware first with configuration of the hardware to have it functional and then provide a video feed. Next, will be the website to test configuration and to make sure the database is working properly. Following integration we will have verification testing to internally test the as built system as a team. Following verification testing we will turn in the prototype and conduct acceptance testing with all stakeholders.

4.1.1.Version of product

The product will be a version 1.0 when the prototype is created. It will provide our guiding principles set from our architecture and further defined in our detailed design specification.

4.1.2. Design Decomposition

4.1.2.1. System level diagram

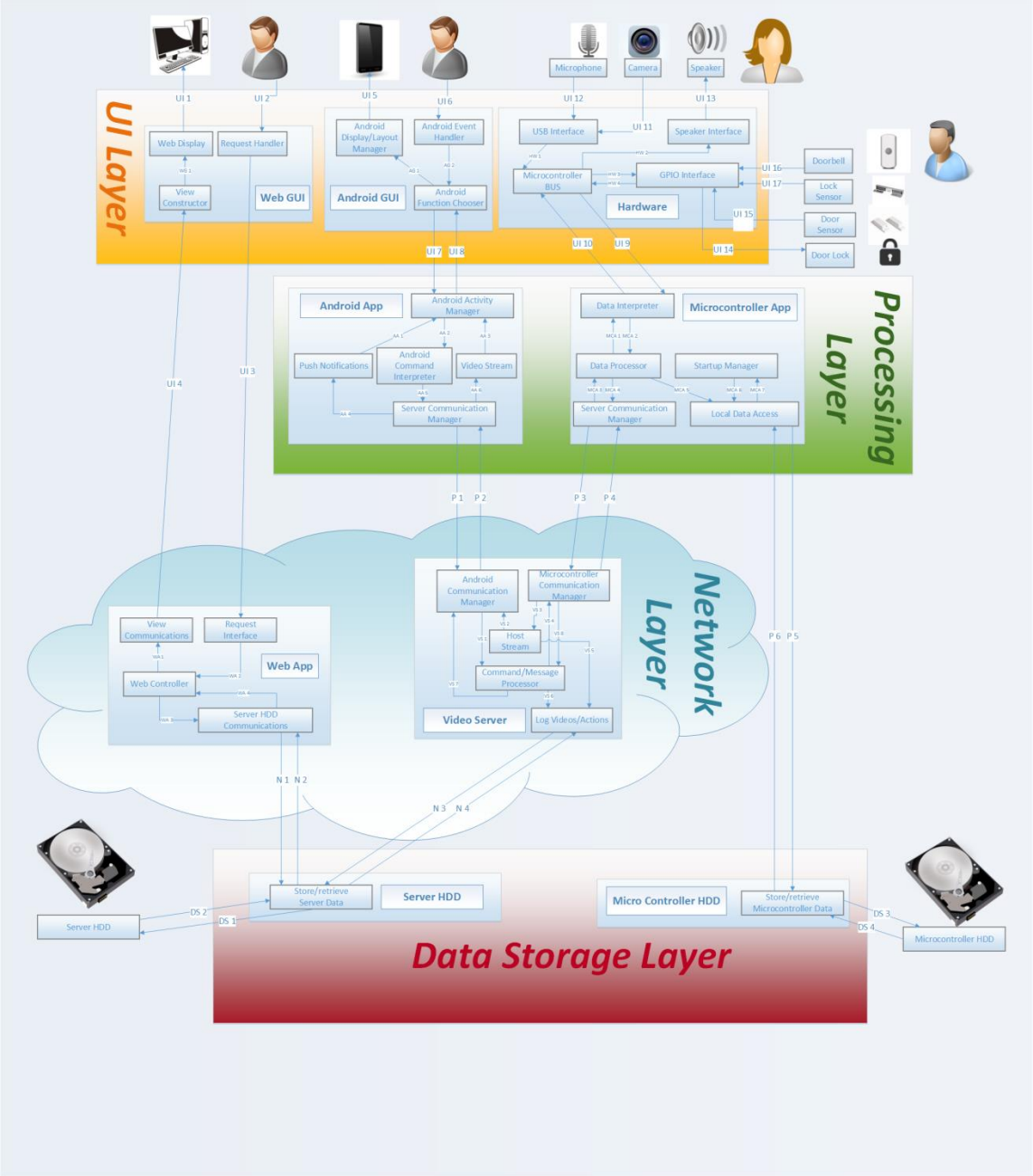

Figure 7: System Level Diagram

4.1.2.2. Limitations of product

4.1.2.3. Future implementation functions

We have included the door lock/unlock feature in our detailed design to have it where we can build it in the future. We will keep it into consideration while creating our prototype.

4.1.2.4. Network Dependency

Our system relies on the hardware to have a network connection to be able to provide a video feed. We will also need to take into consideration when a phone is on a weaker network that is not Wi-Fi such as 4g.

4.1.3. Other Product Level restraints on testing

Due to the fact that the end user installs the system we are unable to verify that all of the hardware requirements are met for each Smart Door device. We are only able to verify that the design prototype meets the requirements thereby providing some assurance that the all of the subsequent devices are able to meet the requirements provided they are installed correctly.

4.2.Requirements Satisfactions

4.2.1.Overview

This is a continual review process that ensures that specified requirements are still feasible and within the scope of our design. The SRS requirements are not engraved in stone. The team will constantly monitor our requirements and receive stakeholder feedback to ensure product viability.

4.2.2.Procedure

Requirements satisfied by the each architectural layer include those noted in the layer's Requirements Satisfaction Matrix. The Requirements Satisfaction Matrix indicates the Test ID of each test that verifies a particular requirement that has been levied on a module of subsystem. The test cases showing satisfaction for the allocated requirements are located in the following sections: 3.3 Unit Test, 3.4 Component Level Testing, 3.5 Integration Testing and 3.6 System Verification Testing.

4.2.3.Findings

All requirements allocated by a particular layer will have been shown to be satisfied following the successful completion of the tests indicated in sections 3.3 Unit Test, 3.4 Component Level Testing, 3.5 Integration Testing and 3.6 System Verification Testing. The results will be recorded in the Test Log following the completion of each test.

23 components contribute to requirement 5.4 Response Time and the total limit is 7 seconds. Each contributing item gets 0.3 seconds allocated to it, if some actions are performed faster the extra time will be re-allocated.

Requirement Satisfaction Tests

	Customer Requirements	*Test Case*
3.1	Smartphone Application Control	AEHUT 1
3.2	Snapshots Taken	ULIT 10
3.3	Keep Activities Log	MBUSUT 1
3.4	Emergency Power Supply	N/A
3.5	Video Monitoring	D/LMUT 1
3.6	System Portability	HRVUT 1
3.7	Smart Phone Paring	SV 9
3.8	Motion Sensor	N/A
3.9	Local Storage	SRMDUT 1
3.10	Hardware Security	HRVUT 2
3.11	Z-Wave	N/A
3.12	Lock/Unlock	PLIT 3
3.13	Open Source	PLIT 4
3.14	Nonintrusive	HRVUT 3
	Packaging Requirements	
4.1	Size	HRVUT 4
4.2	Temperature Control	HRVUT 5
4.3	Mounting	HRVUT 6
4.4	Casing	HRVUT 7
4.5	Software Acquisition	SCUT 1
4.6	Included Components	AT 8
4.7	Team Logo	HRVUT 8
4.8	System Configuration	HRVUT 1
	Safety Requirements	
6.1	Camera Mounting	HRVUT 13
6.2	Microphone Mounting	HRVUT 14
6.3	Camera and Microphone Weather Safety	HRVUT 15
6.4	Receptacles	HRVUT 16

	Performance Requirements	*Test Case*
5.1	System Setup	PLIT 5
5.2	Notification Time	MBUSUT 2
5.3	Latency	PLIT 6
5.4	Response Time	WDUT 1
5.5	Data Transmission - Live Video Feed	PLIT 7
5.6	Data Transmission - Audio Transmission	PLIT 8
5.7	Recording Log - Log Availability	ULIT 1
5.8	Recording Log - Storage Capacity	DSLIT 3
5.9	Power - Power Supply	HRVUT 10
5.10	Power - Power Source	HRVUT 11
5.11	Emergency Backup Battery	N/A
5.12	I/O Ports	SV 1
5.13	Operating Environment	N/A
3.15	Account Setup	ULIT 2
3.16	Video Log Downloads	NLIT 6
5.14	Video/Photo Resolution	NLIT 2
5.15	System Availability	ULIT 14
5.16	Notification Limit	CD 1
5.17	Initialization Time	NLIT 8
5.18	Mounting Height	HRVUT 12
5.20	Microphone Sensitivity	CUI 9
	Maintenance and Support Requirements	
7.1	Software Updates	SV 8
7.2	User Manual	SV 7
7.3	Open Source	NLIT 4
	Other Requirements	
8.1	Web Interface Support	ULIT 3
8.2	Portable Source Code	VCUT 1
8.3	Notification Control	AT 1

Table 12: Requirement Satisfaction Tests

4.2.4.UI Layer

4.2.4.1. Overview

4.2.4.2. Requirements Satisfaction Matrix

UI Layer Requirements Traceability Matrix

		Web GUI			Android Gui			Hardware			
		Web Display	View Constructor	Request Handler	Display/Layout Manager	Android Event Handler	Android Function Handler	USB Interface	Microcontroller BUS	GPIO Interace	Speaker Interface
	Customer Requirements										
3.1	Smartphone Application Control					X	X				
3.2	Snapshots Taken							X	X		
3.3	Keep Activities Log								X		
3.4	Emergency Power Supply										
3.5	Video Monitoring				X	X	X	X	X		
3.6	System Portability							Requirement Satisfied by Smart Door Device			
3.7	Smart Phone Paring										
3.8	Motion Sensor										
3.9	Local Storage							X	X		
3.10	Hardware Security								Requirement Satisfied by Smart Door Device		
3.11	Z-Wave										
3.12	Lock/Unlock					X	X		X	X	
3.13	Open Source								X		
3.14	Nonintrusive								Requirement Satisfied by Smart Door Device		
	Packaging Requirements										
4.1	Size								Requirement Satisfied by Smart Door Device		
4.2	Temperature Control								Requirement Satisfied by Smart Door Device		
4.3	Mounting								Requirement Satisfied by Smart Door Device		
4.4	Casing								Requirement Satisfied by Smart Door Device		
4.5	Software Acquisition					X	X				
4.6	Included Components							X	X	X	X
4.7	Team Logo								Requirement Satisfied by Smart Door Device		
4.8	System Configuration					X	X	X	X	X	X
	Performance Requirements										
5.1	System Setup								X		
5.2	Notification Time								X		
5.3	Latency							X	X	X	X
5.4	Response Time	X	X	X	X	X	X	X	X	X	X
5.5	Data Transmission - Live Video Feed							X	X		
5.6	Data Transmission - Audio Transmission							X	X		X
5.7	Recording Log - Log Availability			X							
5.8	Recording Log - Storage Capacity								Requirement Satisfied by Smart Door Device		
5.9	Power - Power Supply								Requirement Satisfied by Smart Door Device		
5.10	Power - Power Source								Requirement Satisfied by Smart Door Device		
5.11	Emergency Backup Battery										
5.12	I/O Ports							X	X	X	X
5.13	Operating Environment										
3.15	Account Setup			X		X	X				
3.16	Video Log Downloads										
5.14	Video/Photo Resolution							X	X		
5.15	System Availability							X	X	X	X
5.16	Notification Limit								X		
5.17	Initialization Time							X	X	X	X
5.18	Mounting Height								Requirement Satisfied by Smart Door Device		
5.20	Microphone Sensitivity								X		X
	Safety Requirements										
6.1	Camera Mounting								Requirement Satisfied by Smart Door Device		
6.2	Microphone Mounting								Requirement Satisfied by Smart Door Device		
6.3	Camera and Microphone Weather Safety								Requirement Satisfied by Smart Door Device		
6.4	Receptacles								Requirement Satisfied by Smart Door Device		
	Maintenance and Support Requirements										
7.1	Software Updates										
7.2	User Manual										
7.3	Open Source										
	Other Requirements										
8.1	Web Interface Support	X	X	X							
8.2	Portable Source Code										
8.3	Notification Control										

Table 13: UI Requirements Traceability Matrix

4.2.5.Processing Layer

4.2.5.1. Requirements Satisfaction Matrix

Processing Layer Requirements Traceability Matrix

		Android App					Microcontroller App				
		Android Activity	Push Notifications	Android Command Interpreter	Video Stream	Server Communication	Data Interpreter	Data Processor	Startup Manager	Server Communication	Local Data Access
	Customer Requirements										
3.1	Smartphone Application Control	X		X		X					
3.2	Snapshots Taken										
3.3	Keep Activities Log										
3.4	Emergency Power Supply										
3.5	Video Monitoring	X		X	X	X					
3.6	System Portability										
3.7	Smart Phone Paring										
3.8	Motion Sensor										
3.8	Local Storage										
3.10	Hardware Security										
3.11	Z-Wave										
3.12	Lock/Unlock	X		X		X					
3.13	Open Source	X	X	X	X	X	X	X	X	X	X
3.14	Nonintrusive										
	Packaging Requirements										
4.1	Size										
4.2	Temperature Control										
4.3	Mounting										
4.4	Casing										
4.5	Software Acquisition					X					
4.6	Included Components										
4.7	Team Logo										
4.8	System Configuration										
	Performance Requirements										
5.1	System Setup	X		X		X	X	X	X	X	X
5.2	Notification Time	X	X	X		X	X	X		X	X
5.3	Latency	X		X		X	X	X		X	X
5.4	Response Time	X		X		X	X	X		X	X
5.5	Data Transmission - Live Video Feed	X		X	X	X	X	X		X	
5.6	Data Transmission - Audio Transmission	X		X		X	X	X		X	
5.7	Recording Log - Log Availability										
5.8	Recording Log - Storage Capacity										
5.9	Power - Power Supply										
5.10	Power - Power Source										
5.11	Emergency Backup Battery										
5.12	I/O Ports										
5.13	Operating Environment										
3.15	Account Setup	X		X		X		X		X	X
3.16	Video Log Downloads	X		X		X		X		X	X
5.14	Video/Photo Resolution										
5.15	System Availability	X		X		X	X	X	X	X	X
5.16	Notification Limit	X	X				X	X		X	X
5.17	Initialization Time	X		X		X	X		X	X	X
5.18	Mounting Height										
5.20	Microphone Sensitivity	Requirement Satisfied by Android Device									
	Safety Requirements										
6.1	Camera Mounting										
6.2	Microphone Mounting										
6.3	Camera and Microphone Weather Safety										
6.4	Receptacles										
	Maintenance and Support Requirements										
7.1	Software Updates	X	X	X	X	X	X	X	X	X	X
7.2	User Manual						X				
7.3	Open Source	X	X	X	X	X	X	X	X	X	X
	Other Requirements										
8.1	Web Interface Support										
8.2	Portable Source Code	X	X	X	X	X	X	X	X	X	X
8.3	Notification Control	X	X								

Table 14: Processing Requirements Traceability Matrix

4.2.6. Network Layer

4.2.6.1. Requirements Satisfaction Matrix

Network Layer Requirements Traceability Matrix										
		Web App				Video Server				
		View Communicatio	Request Interface	Web Controller	Server HDD Communications	Android Communication	Microcontroller Communication Manager	Host Stream	Command/Message Processor	Log Videos/Actions
	Customer Requirements									
3.1	Smartphone Application Control									
3.2	Snapshots Taken									
3.3	Keep Activities Log					X	X		X	X
3.4	Emergency Power Supply									
3.5	Video Monitoring					X	X	X	X	
3.6	System Portability									
3.7	Smart Phone Paring									
3.8	Motion Sensor									
3.8	Local Storage									
3.10	Hardware Security									
3.11	Z-Wave									
3.12	Lock/Unlock					X	X		X	X
3.13	Open Source	X	X	X	X	X	X	X	X	X
3.14	Nonintrusive									
	Packaging Requirements									
4.1	Size									
4.2	Temperature Control									
4.3	Mounting									
4.4	Casing									
4.5	Software Acquisition									
4.6	Included Components									
4.7	Team Logo									
4.8	System Configuration					X	X		X	
	Performance Requirements									
5.1	System Setup	X	X	X	X	X	X		X	
5.2	Notification Time					X	X		X	X
5.3	Latency					X	X	X	X	
5.4	Response Time					X	X	X	X	
5.5	Data Transmission - Live Video Feed					X	X	X		
5.6	Data Transmission - Audio Transmission					X	X	X		
5.7	Recording Log - Log Availability	X	X	X	X	X				X
5.8	Recording Log - Storage Capacity									
5.9	Power - Power Supply									
5.10	Power - Power Source									
5.11	Emergency Backup Battery									
5.12	I/O Ports									
5.13	Operating Environment									
3.15	Account Setup	X	X	X	X	X	X		X	
3.16	Video Log Downloads	X	X	X	X	X	X		X	X
5.14	Video/Photo Resolution									
5.15	System Availability	X	X	X	X	X	X	X	X	X
5.16	Notification Limit					X	X		X	
5.17	Initialization Time					X	X		X	
5.18	Mounting Height									
5.20	Microphone Sensitivity									
	Safety Requirements									
6.1	Camera Mounting									
6.2	Microphone Mounting									
6.3	Camera and Microphone Weather Safety									
6.4	Receptacles									
	Maintenance and Support Requirements									
7.1	Software Updates	X	X	X	X					
7.2	User Manual									
7.3	Open Source	X	X	X	X	X	X	X	X	X
	Other Requirements									
8.1	Web Interface Support									
8.2	Portable Source Code	X	X	X	X					
8.3	Notification Control									

Table 15: Network Requirements Traceability Matrix

4.2.7. Data Storage Layer

4.2.7.1. Requirements Satisfaction Matrix

Data Storage Layer Requirements Traceability Matrix					
		Server HDD		Microcontroller HDD	
		Store/Retrieve Server Data	Server HDD	Store/Retrieve Microcontorller Data	Microcontroller HDD
	Customer Requirements				
3.1	Smartphone Application Control				
3.2	Snapshots Taken				
3.3	Keep Activities Log	X	X	X	X
3.4	Emergency Power Supply				
3.5	Video Monitoring				
3.6	System Portability				
3.7	Smart Phone Paring				
3.8	Motion Sensor				
3.8	Local Storage			X	X
3.10	Hardware Security				
3.11	Z-Wave				
3.12	Lock/Unlock				
3.13	Open Source				
3.14	Nonintrusive				
	Packaging Requirements				
4.1	Size				
4.2	Temperature Control				
4.3	Mounting				
4.4	Casing				
4.5	Software Acquisition				
4.6	Included Components				
4.7	Team Logo				
4.8	System Configuration				
	Performance Requirements				
5.1	System Setup				
5.2	Notification Time				
5.3	Latency				
5.4	Response Time	X	X	X	X
5.5	Data Transmission - Live Video Feed				
5.6	Data Transmission - Audio Transmission				
5.7	Recording Log - Log Availability	X	X	X	X
5.8	Recording Log - Storage Capacity	X	X	X	X
5.9	Power - Power Supply				
5.10	Power - Power Source				
5.11	Emergency Backup Battery				
5.12	I/O Ports				
5.13	Operating Environment				
3.15	Account Setup				
3.16	Video Log Downloads	X	X		
5.14	Video/Photo Resolution				
5.15	System Availability				
5.16	Notification Limit				
5.17	Initialization Time				
5.18	Mounting Height				
5.20	Microphone Sensitivity				
	Safety Requirements				
6.1	Camera Mounting				
6.2	Microphone Mounting				
6.3	Camera and Microphone Weather Safety				
6.4	Receptacles				
	Maintenance and Support Requirements				
7.1	Software Updates				
7.2	User Manual				
7.3	Open Source				
	Other Requirements				
8.1	Web Interface Support				
8.2	Portable Source Code				
8.3	Notification Control				

Table 16: Data Storage Requirements Traceability Matrix

4.3. Hardware Validation Tests

4.3.1. Test Assumptions

Hardware validation testing assumes that the prototype is complete.

Hardware validation testing assumes that the end user can follow instructions in order to duplicate the results of the validation.

4.3.2. Test Requirements

Requirements for hardware validation are driven by system level requirements that would not be satisfied by the software in the Smart Door system. These requirements can be demonstrated to have been satisfied by the prototype. However, there is no guarantee that the end user will comply with the included installation instructions and satisfy the mounting and installation related requirements.

4.3.3. Test Dependencies

The Hardware Validation tests depend on a completed Smart Door Prototype or suitable mockup being made available for testing.

4.3.4. Test Data

4.3.4.1. Test Cases

Hardware Requirement Validation Tests							
Test ID	**Module**	**Description**	**Input**	**Expected Output/Action**	**Requirement Priority**	**Risk**	**Requirements Satisfied**
HRVUT 1	Smart Door Device	Evaluate Smart Dor Prototype to ensure that it is portable	Subjective Evaluation by Sponsor	Smart Door prototype will be found to be portable	2 - High	4 - Inconclusive	3.6 System Portability
HRVUT 2	Smart Door Device	Enclose Smart Door Prototype in its secure enclosure and make available for evaluation	Subjective Evaluation by Sponsor	Smart Door prototype will be found to be secure	2 - High	2 - Moderate	3.10 Hardware Security
HRVUT 3	Smart Door Device	Install Smart Door Prototype in a representative location and make available for evaluation	Subjective Evaluation by Sponsor	Smart Door prototype will be found to be nonintrusive	1 - Critical	4 - Inconclusive	3.14 Nonintrusive
HRVUT 4	Smart Door Device	Measure the protoype device's deminsions to assure that it meets the requirement	Smart Door Prototype and measuring tape	Smart Door prototype fits within the required size	1 - Critical	2 - Moderate	4.1 Size
HRVUT 5	Smart Door Device	Operate the Smart Door Prototype through a range of temperatures	Operate the smart door prototype inside a freezer and outside in TX heat	Smart Door prototype will continue to operate in the representive environments	3 - Moderate	3 - Low	4.2 Temperature Control
HRVUT 6	Smart Door Device	Mount the Smart Door prototype using the included brackets	Smart Door prototype and mounting bracket	The Smart Door prototype will be installed succesfully	1 - Critical	3 - Low	4.3 Mounting
HRVUT 7	Smart Door Device	Verify that the Smart Door prototype is installed in a protective case	Subjective Evaluation by Design Team	Smart Door prototype will be found to be enclosed	2 - High	2 - Moderate	4.4 Casing
HRVUT 8	Smart Door Device	Verify that the always home logo is displayed on the Smart Door prototype	Subjective Evaluation by Design Team	Smart Door prototype will be found to be enclosed	4 - Low	3 - Low	4.7 Team Logo
HRVUT 9	Smart Door Device	Ensure that at least 32 GB is available for storage	Inspection of SD Card's properties using Windows 7 OS to ensure adequate storage	Storage will exceed 23GBs	3 - Moderate	3 - Low	5.8 Recording Log -Log availability
HRVUT 10	Smart Door Device	Inspect USB power supply to ensure the voltages operate the Smart Door prototype	USB power supply	Power Supply will operate the prototype	1 - Critical	3 - Low	5.9 Power - Power Supply
HRVUT 11	Smart Door Device	Install and operate the Smart Door prototype to ensure it functions on 120VAC	Household wiring and receptacle	Wiring will operate the prototype	1 - Critical	3 - Low	5.10 Power - Power Source
HRVUT 12	Smart Door Device	Mount the Smart Door prototype at a height between 60 and 66 inches	Smart Door Prototype and measuring tape	Smart Door Prototype will be usable at the indicated height	1 - Critical	4 - Inconclusive	5.18 Mounting Height
HRVUT 13	Smart Door Device	Install Smart Door Prototype in a representative location and make available for evaluation	Subjective Evaluation by Design Team	Smart Door prototype will be found to be securely mounted	3 - Moderate	4 - Inconclusive	6.1 Camera Mounting
HRVUT 14	Smart Door Device	Install Smart Door Prototype in a representative location and make available for evaluation	Subjective Evaluation by Design Team	Smart Door prototype will be found to be securely mounted	3 - Moderate	4 - Inconclusive	6.2 Microphone Mounting
HRVUT 15	Smart Door Device	Install Smart Door Prototype in a representative location and make available for evaluation	Subjective Evaluation by Design Team	Smart Door prototype will be found to be installable during described weather conditions	1 - Critical	4 - Inconclusive	6.3 Camera and Microphone Weather Safety
HRVUT 16	Smart Door Device	Ensure that the provided receptacle is adequate	Voltmeter to test receptacle	Receptacle found to be adequate	5 - Future	5 - Future	6.4 Receptacles

Table 17: Hardware Verification Test Cases

4.4. Unit Test (Module Level)

Module and Unit level testing are iterative processes. We will conduct module level testing upon the completion of each module and we will conduct unit level testing upon the completion of related modules.

Module level testing will be defined as validating and verifying the internal functions within each module upon the completion of implementing the module. Unit testing will be defined as testing the interfaces and data transfer between two related modules. Modules are defined as related if they exchange any messages or information between each other. Module and Unit level testing will not include interfaces across subsystem boundaries. These interfaces will be tested during Integration testing.

4.4.1. Test Assumptions

Module level testing assumes that the module has been completely implemented and debugged.

Unit level testing assumes that each participating module has been implemented and debugged.

4.4.2. Test Requirements

Requirements will be generated for each module based on the system level requirements they are intended to fulfill according to the requirements traceability matrix. Additional functional requirements will assure that the module fulfills its function within the subsystem.

4.4.3. Test Dependencies

The Module level tests are intended to have no external dependencies since they are only testing internal functionality of a module.

Unit level testing will depend on the proper implementation of each participating module. Additionally, unit level testing will not complete successfully unless each participating module adheres to its interface requirements.

4.4.4. Test Data

4.4.4.1. Test Cases

4.4.4.1.1. UI Layer Unit Tests

UI Layer Unit tests							
Test ID	**Module**	**Description**	**Input**	**Expected Output/Action**	**Requirement Priority**	**Risk**	**Requirements Satisfied**
WDUT 1	Web Display	Establish that the time to initiate an action through the Web Interface is faster than 0.3 seconds.	Navigate through website while timing length of time to load pages.	Action on website will take less than 0.3 seconds to complete.	1 - Critical	1 - High	5.4 Response Time
WDUT 2	Web Display	Establish that the time to display an interaction event through the Web Interface is faster than 0.3 seconds.	Click on a video title and time how long to start downloading video.	Video download will take less than 0.3 seconds to initiate.	1 - Critical	1 - High	5.4 Response Time
VCUT 1	View Constructor	Establish that the time to process an action through the View Constructor is faster than 0.3 seconds.	Navigate through website while timing length of time to load pages.	Action on website will take less than 0.3 seconds to complete.	1 - Critical	1 - High	5.4 Response Time
VCUT 2	View Constructor	Establish that the time to initiate an action through the View Constructor is faster than 0.3 seconds.	Click on a video title and time how long to start downloading video.	Video download will take less than 0.3 seconds to initiate.	1 - Critical	1 - High	5.4 Response Time
RHUT 1	Request Handler	Establish that the time to process an action through the Request Handler is faster than 0.3 seconds.	Navigate through website while timing length of time to load pages.	Action on website will take less than 0.3 seconds to complete.	1 - Critical	1 - High	5.4 Response Time
RHUT 2	Request Handler	Establish that the time to initiate an action through the Request Handler is faster than 0.3 seconds.	Click on a video title and time how long to start downloading video.	Video download will take less than 0.3 seconds to initiate.	1 - Critical	1 - High	5.4 Response Time
D/LMUT 1	Display/Layout Manager	Verify that the video window displays correctly in the Android Application	Watch a streaming video in the android app	The video is visible in the central region of the application window	2 - High	3 - Low	3.5 Video Monitoring
D/LMUT 2	Display/Layout Manager	Establish that the time to pass an interaction event utilizing the Display/Layout Manager is faster than 0.3 seconds.	Navigate through website while timing length of time to load pages.	Action on website will take less than 0.3 seconds to complete.	1 - Critical	1 - High	5.4 Response Time
D/LMUT 3	Display/Layout Manager	Establish that the time to initiate an action through the Web Interface is faster than 0.3 seconds.	Click on a video title and time how long to start downloading video.	Video download will take less than 0.3 seconds to initiate.	1 - Critical	1 - High	5.4 Response Time
AEHUT 1	Android Event Handler	Establish that the time to pass an interaction event through the Android Event Handler is faster than 0.3 seconds.	Navigate through website while timing length of time to load pages.	Action on website will take less than 0.3 seconds to complete.	1 - Critical	1 - High	5.4 Response Time
AEHUT 2	Android Event Handler	Process commands for device control using the Android Application	User Commands	System will respond correctly to given user commands	1 - Critical		3.1 Smartphone Application Control
AFHUT 1	Android Function Handler	Establish that the time to pass an interaction event through the Android Function Handler is faster than 0.3 seconds.	Navigate through website while timing length of time to load pages.	Action on website will take less than 0.3 seconds to complete.	1 - Critical	1 - High	5.4 Response Time
AFHUT 2	Android Function Handler	Establish that the time to process an interaction event through the Android Function Handler is faster than 0.3 seconds.	Click on a video title and time how long to start downloading video.	Video download will take less than 0.3 seconds to initiate.	1 - Critical	1 - High	5.4 Response Time
AFHUT 3	Android Function Handler	Process commands for device control using the Android Application	User Commands	System will respond correctly to given user commands	1 - Critical	3 - Low	3.1 Smartphone Application Control
MBUSUT 1	Microcontroller BUS	Send the logging message upon the receipt of signal data from hardware devices	Digital Signal from USB devices	Actions are logged	1 - Critical	3 - Low	3.3 Keep Activities Log
MBUSUT 2	Microcontroller BUS	Establish that the Microcontroller is sending the notifications within an acceptable timeframe	Digital Signal from GPIO connected device	Actions are logged	2 - High	3 - Low	5.2 Notification Time

Table 18: UI Layer Unit Tests

4.4.4.1.2. Processing Layer Unit Tests

Processing Layer Unit tests							
Test ID	**Module**	**Description**	**Input**	**Expected Output/Action**	**Requirement Priority**	**Risk**	**Requirements Satisfied**
SCUT 1	Server Communication Manager	Download the Software from the internet in order to verify that it is available there	User Data	Software is downloaded	1 - Critical	3 - Low	4.5 Software Acquisition
AAMUT 1	Android Activity Manager	Establish that the notifications are passed through the module within an acceptable timeframe	Notification from Smart Door Prototype	Notification is passed within acceptable time 1.5 seconds	2 - High	3 - Low	5.2 Notification Time
ACIUT 1	Android Command Interpreter	Establish that the notifications are passed through the module within an acceptable timeframe	Notification from Smart Door Prototype	Notification is passed within acceptable time 1.5 seconds	2 - High	3 - Low	5.2 Notification Time
AASCMUT 1	Server Communication Manager	Establish that the notifications are passed through the module within an acceptable timeframe	Notification from Smart Door Prototype	Notification is passed within acceptable time 1.5 seconds	2 - High	3 - Low	5.2 Notification Time
DIUT 1	Data Interpreter	Establish that the notifications are passed through the module within an acceptable timeframe	Notification from Smart Door Prototype	Notification is passed within acceptable time 1.5 seconds	2 - High	3 - Low	5.2 Notification Time
DPUT 1	Data Processor	Establish that the notifications are passed through the module within an acceptable timeframe	Notification from Smart Door Prototype	Notification is passed within acceptable time 1.5 seconds	2 - High	3 - Low	5.2 Notification Time
LDAUT 1	Local Data Access	Establish that the notifications are passed through the module within an acceptable timeframe	Notification from Smart Door Prototype	Notification is passed within acceptable time 1.5 seconds	2 - High	3 - Low	5.2 Notification Time
MASCMUT 1	Server Communication Manager	Establish that the notifications are passed through the module within an acceptable timeframe	Notification from Smart Door Prototype	Notification is passed within acceptable time 1.5 seconds	2 - High	3 - Low	5.2 Notification Time
PNUT 1	Push Notifications	Establish that the notifications are passed through the module within an acceptable timeframe	Notification from Smart Door Prototype	Notification is passed within acceptable time 1.5 seconds	2 - High	3 - Low	5.2 Notification Time
AAMUT 2	Android Activity Manager	Establish that the time to relay an action message through the module is faster than 0.3 seconds.	System action message	Module relays message in less than 0.3 seconds	1 - Critical	1 - High	5.4 Response Time
ACIUT 2	Android Command Interpreter	Establish that the time to relay an action message through the module is faster than 0.3 seconds.	System action message	Module relays message in less than 0.3 seconds	1 - Critical	1 - High	5.4 Response Time
AASCMUT 2	Server Communication Manager	Establish that the time to relay an action message through the module is faster than 0.3 seconds.	System action message	Module relays message in less than 0.3 seconds	1 - Critical	1 - High	5.4 Response Time
DIUT 2	Data Interpreter	Establish that the time to relay an action message through the module is faster than 0.3 seconds.	System action message	Module relays message in less than 0.3 seconds	1 - Critical	1 - High	5.4 Response Time
DPUT 2	Data Processor	Establish that the time to relay an action message through the module is faster than 0.3 seconds.	System action message	Module relays message in less than 0.3 seconds	1 - Critical	1 - High	5.4 Response Time
LDAUT 2	Local Data Access	Establish that the time to relay an action message through the module is faster than 0.3 seconds.	System action message	Module relays message in less than 0.3 seconds	1 - Critical	1 - High	5.4 Response Time
MASCMUT 2	Server Communication Manager	Establish that the time to relay an action message through the module is faster than 0.3 seconds.	System action message	Module relays message in less than 0.3 seconds	1 - Critical	1 - High	5.4 Response Time

Table 19: Processing Layer Unit Tests

4.4.4.1.3. Network Layer Unit Tests

Network Layer Unit Tests							
Test ID	**Module**	**Description**	**Input**	**Expected Output/Action**	**Requirement Priority**	**Risk**	**Requirements Satisfied**
VCUT 1	View Communications	Each module needs to be compatible with a wide range of browsers in order for the product to be accepted	Firefox, Chrome, Opera, IE, Native Android Browser	The website will work correctly on each browser	5 - Future	2 - Moderate	8.2 Portable Source Code
RIUT 1	Request Interface	Each module needs to be compatible with a wide range of browsers in order for the product to be accepted	Firefox, Chrome, Opera, IE, Native Android Browser	The website will work correctly on each browser	5 - Future	2 - Moderate	8.2 Portable Source Code
WCUT 1	Web Controller	Each module needs to be compatible with a wide range of browsers in order for the product to be accepted	Firefox, Chrome, Opera, IE, Native Android Browser	The website will work correctly on each browser	5 - Future	2 - Moderate	8.2 Portable Source Code
SHCUT 1	Server HDD Communications	Each module needs to be compatible with a wide range of browsers in order for the product to be accepted	Firefox, Chrome, Opera, IE, Native Android Browser	The website will work correctly on each browser	5 - Future	2 - Moderate	8.2 Portable Source Code

Table 20: Network Layer Unit Tests

4.4.4.1.4. Data Storage Layer Unit Tests

Data Storage Layer Unit Tests							
Test ID	**Module**	**Description**	**Input**	**Expected Output/Action**	**Requirement Priority**	**Risk**	**Requirements Satisfied**
SRMDUT 1	Store/Retrieve Microcontroller Data	Record a video without being connected to WIFI then reconnect to WIFI and verify that the video is uploaded from local storage	A video Interaction	The video is uploaded to the Server HDD	2 - High	3 - Low	3.9 Local Storage
MHUT 1	Microcontroller HDD	Boot the Smart Door Prototype in order to validate that the Microcontroller Application data is being properly stored on the HDD	Turn on the Unit and verify that it boots correctly	The Smart Door Device will boot correctly	2 - High	3 - Low	3.9 Local Storage
SHUT 1	Server HDD	Establish that the time to relay an action message through the module is faster than 0.3 seconds.	System action message	Module relays message in less than 0.3 seconds	1 - Critical	1 - High	5.4 Response Time
MHUT 2	Microcontroller HDD	Establish that the time to relay an action message through the module is faster than 0.3 seconds.	System action message	Module relays message in less than 0.3 seconds	1 - Critical	1 - High	5.4 Response Time

Table 21: Data Storage Layer Unit Tests

4.5.Component level (Subsystem) Testing

Component level testing will test the functionality and internal data communication of each individual subsystem. Component level testing will not include interfaces across subsystem or architectural layer boundaries. These interfaces will be tested during Integration testing.

4.5.1.Test Assumptions

Component level testing assumes that each module within the subsystem has passed module level testing.

Component level testing assumes that each subset of related modules within a subsystem has passed unit level testing.

4.5.2. Test Requirements

Requirements will be generated for each subsystem based on the system level requirements they are intended to fulfill according to the requirements traceability matrix. Additional functional requirements will assure that the subsystem fulfills its function within the overall system.

4.5.3. Test Dependencies

Component level tests are intended to test the subsystem's internal functionality. This means that the component level tests are dependent on the module and unit level tests being passed successfully. Component level tests depend on each module adhering to its defined interface requirements in order for communication testing to complete successfully.

4.5.4. Test Cases

4.5.4.1. UI Layer

Test ID	Subsystem	Description	Input	Expected Output/Action	Requirement Priority	Risk	Requirements Satisfied
CUI1	Web GUI	The User wll be able to click a button or link on the website to be able to switch from page to page	Button or URL Click	Request to retreive a page	critical-1	risk 3	5.4 3.15
CUI2	Web GUI	The User will fill out a form to create an account and be able to submit it	Button Click	JSON list of the form of username, password, registered mobile device, and registered hardware	critical-1	risk 1	5.4
CUI3	Web GUI	The User will see a page on the website either the page they want or an error page	200: with page needed, error page if bad request	html page	critical-1	risk 2	5.4
CUI4	Web GUI	The User will be able to click a button to download a video	Button Click	Selected video	critical-1	risk 3	5.4 5.7
CUI5	Android GUI	The User will click a button on the login screen to log into there account	Button Click ,username, and password	ActionListener, username in variable, and password in variable	critical-1	risk 3	5.4
CUI6	Android GUI	The User will click a button on the accept call screen	Accept Button Click	ActionListener to pull up new page call screen	critical-1	risk 3	5.4
CUI7	Android GUI	The User will click a button on the accept call screen	Decline Button Click	ActionListener to end stream	critical-1	risk 3	5.4
CUI8	Android GUI	The User will click a button on the menu screen to start monitoring	Start Monitor Button Click	ActionListener to request start monitoring	critical-1	risk 3	5.4
CUI9	Android GUI	The User will see a video and audio stream as well as action buttons	XML format	the call screen	critical-1	risk 1	5.13 5.4
CUI10	Android GUI	The User will see a login page if they have not logged in	XML format	the login screen	critical-1	risk 1	5.13 5.4
CUI11	Android GUI	The User will see the menu screen when they are logged in	XML format	the main menu screen	critical-1	risk 1	5.13 5.4
CUI12	Android GUI	The User will see the incoming call screen when the doorbell button has been pressed	XML format	the incoming call screen	critical-1	risk 1	5.13 5.4
CUI13	Android GUI	The User will be able to talk to another user	audio	audio stream	critical-1	risk 2	5.4
CUI14	Hardware	The User will be able to press the doorbell to be able to start a call	Button Click	Signal of the button press	critical-1	risk 3	
CUI15	Hardware	The User will be able to talk into the microphone	audio	audio stream	critical-1	risk 3	
CUI16	Hardware	The User will be able to hear another user through the speaker	audio stream	audio	critical-1	risk 2	
CUI17	Hardware	The subsystem will allow messages from the sensors to give a state	message	door state value	future-5	risk 1	
CUI18	Hardware	The subsystem will allow video stream of the user	video	h.246 video stream	critical-1	risk 3	

Table 22: UI Layer Component Tests

4.5.4.2. Processing Layer

Test ID	Subsystem	Description	Input	Expected Output/Action	Requirement Priority	Risk	Requirements Satisfied
CP1	Android App	The subsystem will take in door state	request	int door state message	future-5	risk 1	
CP2	Android App	The subsystem will begin monitoring	request	int begin monitorting message	medium-2	risk 2	
CP3	Android App	The subsystem will take in video stream and audio stream	video/audio stream	video/audio file	critical-1	risk 2	
CP4	Android App	The subsystem will take in audio and pass it to the server	audio file	audio	critical-1	risk 2	
CP5	Android App	The subsystem will prepare and send out push notifications	int message	push notification	medium-2	risk 2	
CP6	Microcontroller App	The subsystem will take in a video and audio stream and send it to the server	h.246 video/audio	h.246 video/audio	critical-1	risk 2	
CP7	Microcontroller App	The subsystem will take in messages from hardware and send it if there is Wi-Fi	int message for doorbell button click	int message	critical-1	risk 3	
CP8	Microcontroller App	The subsystem will take in messages from hardware and send it if there is Wi-Fi	int message for the door sensor and lock sensor	int doorstate	future-5	risk 1	
CP9	Microcontroller App	Will test to see if there is Wi-FI connection, if there is send it to server if not send it to Local data	check for Wi-Fi connection	struct of messages and videos/audio	critical-1	risk 3	

Table 23: Processing Layer Component Tests

4.5.4.3. Network Layer

Test ID	Subsystem	Description	Input	Expected Output/Action	Requirement Priority	Risk	Requirements Satisfied
CN1	Web App	This will take in a request for a page	Request for a page	page for an error or the page that is correctly requested	medium-2	risk 3	
CN2	Web App	This will set up the request the videos from the server	request for videos for a user	Select from video table MySQL statement	critical-1	risk 3	
CN3	Web App	Save account information when creating an account	JSON list of account information	Insert into user info table MySQL statement	critical-1	risk 3	
CN4	Video Server	The server will take the audio from the Android Device and prepare it for the microcontroller	Audio stream	Audio Stream	critical-1	risk 1	
CN5	Video Server	The server will take the video/audio from the microcontroller and prepare it for the Android Device	Video/Audio Stream	Video/Audio Stream	critical-1	risk 1	
CN6	Video Server	The server will convert the message from Microcontroller to be set-up for the Android device	Int Message	Int Message	critical-1	risk 1	
CN7	Video Server	The server will convert the message from Android Device to set-up for the Microcontroller	Int Message	Int Message	critical-1	risk 1	
CN8	Video Server	After a video hosting is completed, prepare it to be saved to Database	Video/Audio Stream	Insert into video tableMySQL statement	critical-1	risk 2	

Table 24: Network Layer Component Tests

4.5.4.4. Data Storage Layer

Test ID	Subsystem	Description	Input	Expected Output/Action	Requirement Priority	Risk	Requirements Satisfied
CD1	Server HDD	Store Videos/Accounts into the database	Insert MySQL statement into table	Successful or Unsuccessful insert into Database	critical-1	risk 3	
CD2	Server HDD	Retreve Video List	Select statement MySQL statement	Results query	critical-1	risk 3	
CD3	Micro Controller HDD	Store Videos/Accounts into the database	Video/Audio	Video/Audio file	critical-1	risk 3	
CD4	Micro Controller HDD	Retreve Video List	Video/Audio file	Video/Audio	critical-1	risk 3	

Table 25: Data Storage Layer Component Tests

4.6.Integration Test

4.6.1.Layer integration

4.6.1.1. Test Assumptions

Layer Integration testing assumes that all modules have been completed and that all unit level tests are completed.

4.6.1.2. Test Cases

4.6.1.2.1. UI Layer

UI Layer Integration Test Cases							
Test ID	**Modules**	**Description**	**Input**	**Expected Output/Action**	**Requirement Priority**	**Risk**	**Requirements Satisfied**
ULIT 1	Request Handler	Verify that log has been updated within five minutes of an interaction ending	The elapsed time between the completion of an action and the posting of the action to the log	Interactions are visible on the Log in less than five minutes	3 - Moderate	3 - Low	5.7 Recording Log - Log Availability
ULIT 2	Request Handler, Android Event Handler, Android Function Handler	Complete the procedure to pair the Smart Door device to an Android device	Pairing Key	Smart Door Device is paired to the users smart phone	2 - High	3 - Low	3.15Account Setup
ULIT 3	Web Display, View Constructor, Request Handler	Initiate video monitoring from the Web Interface	Navigate Web GUI to Initiate video monitoring from the Web Interface	Video stream is displayed on the website	1. Critical	3 - Low	8.1 Web Interface Support
ULIT 4	Web Display, View Constructor, Request Handler	Download a video using the Web Interface	Navigate Web GUI to Download a video using the Web Interface	video download progress is displayed in the web browser	1. Critical	3 - Low	8.1 Web Interface Support
ULIT 5	Web Display, View Constructor, Request Handler	Demonstrate lock/unlock functionality through the Web Interface	Navigate Web GUI to lock and unlock the connected door	Lock/unlock notifications are displayed on the website	1. Critical	3 - Low	8.1 Web Interface Support
ULIT 6	Web Display	Demonstrate door status monitoring capability through the Web Interface	Navigate Web GUI to display the attached door's status (open/closed, locked/unlocked)	Door status is displayed on the website	1. Critical	3 - Low	8.1 Web Interface Support
ULIT 7	Display/Layout Manager, Android Event Handler, Android Function Handler, USB Interface, Microcontroller Bus	Verify that the video window displays correctly in the Android Application	Watch a streaming video in the android app	The video is visible in the central region of the application window	2 - High	3 - Low	3.5 Video Monitoring
ULIT 8	USB Interface, Microcontroller BUS	Verify Interaction records and video logs are stored on microcontroller Hard drive when internet is not available to the device	Disconnect WIFI module form the microcontroller then initiate the system by pressing the doorbell	Notifications and video of interaction are stored on the microcontroller hard drive	2 - High	3 - Low	3.9 Local Storage
ULIT 9	Android event Handler, Android Function Handler	Verify that actions requested in the smartphone GUI are completed by the remainder of the system components	Initiate video Monitoring through the android application	View a live video stream in the android application	1. Critical	3 - Low	3.1 Smartphone Application control
ULIT 10	USB Interface, Microcontroller BUS	Verify that snapshots are taken upon the pressing of the attached doorbell	Press the doorbell	Snapshot is sent with notification	1. Critical	3 - Low	3.2 Snapshots taken
ULIT 11	Microcontroller BUS, GPIO Interface, USB Interface, Speaker Interface	Verify that total system latency is less than 10 seconds	Record the length of time it takes for a notification to arrive after the doorbell is pushed	Notification should arrive in less than ten seconds	2 - High	1 - High	5.3 Latency
ULIT 12	Web Display, View Constructor, Request Handler, Display/Layout Manager, Android Event Handler, Android Function Handler, Microcontroller BUS, GPIO Interface, USB Interface, Speaker Interface	Establish that the time to complete an action using the system is faster than 7 seconds.	Record the time from pressing the doorbell until the paired android device rings	Response time should be less than seven seconds	1 - Critical	1 - High	5.4 Response Time
ULIT 13	Web Display, View Constructor, Request Handler, Display/Layout Manager, Android Event Handler, Android Function Handler, Microcontroller BUS, GPIO Interface, USB Interface, Speaker Interface	Establish that the time to pass an interaction event through the system is faster than 7 seconds.	Navigate through website while timing length of time to load pages.	Response time should be less than seven seconds	1 - Critical	1 - High	5.4 Response Time
ULIT 14	Microcontroller BUS, GPIO Interface, USB Interface, Speaker Interface	Insure that the system availability exceeds 95%	Record the uptime of the microcontroller during a one week period and calculate the percent availability	Availability should be above 95% up-time	2 - High	3 - Low	5.15 System Availability

Table 26: UI Layer Integration Tests

4.6.1.2.2. Processing Layer

Processing Layer Integration Tests							
Test ID	**Modules**	**Description**	**Input**	**Expected Output/Action**	**Requirement Priority**	**Risk**	**Requirements Satisfied**
PLIT 1	Android Activity Manager, Android Command Interpreter, Server Communication Manager	Check the Status of the Lock and Door sensors using the Android Application	Touch controls on the Android Application	Door and Lock status messages will be available in the Android Application	1 - Critical	3 - Low	3.1 Smartphone Application Control
PLIT 2	Android Activity Manager, Android Command Interpreter, Video Stream Server Communication Manager	Use the Android Application to initiate video monitoring	Touch controls on the Android Application	Video Monitoring will be available in the Android Application	2 - High	3 - Low	3.5 Video Monitoring
PLIT 3	Android Activity Manager, Android Command Interpreter, Server Communication Manager	Lock and Unlock the connected door using the Android Application	Touch controls on the Android Application	The Door will Lock and Unlock	5 - Future	5 - Future	3.12 Lock/Unlock
PLIT 4	ALL modules in Processing Layer	Verify that all software is open source by verifying that the GNU license is attached to the software distribution	GNU License	Software will be found to be open source	1 - Critical	3 - Low	3.13 Open Source, 7.3 Open Source
PLIT 5	Android Activity Manager, Android Command Interpreter, Server Communication Manager , ALL Microcontroller Application Modules	Verify that the system is able to be setup, any malfunction in the Processing Layer will prevent a successful system setup	User Data	System will be setup correctly	3 - Moderate	3 - Low	5.1 System Setup
PLIT 6	Android Activity Manager, Android Command Interpreter, Server Communication Manager , ALL Microcontroller Application Modules	This requirement is considered satisfied it the Unit Tests for requirements 5.2 Notification Time and 5.4 Response Time are met	Test results from unit tests conducted on the Smart Door Prototype	It is expected that 5.2,5.3, and 5.4 will be satisfied by the Smart Door Prototype	2 - High	2 - Moderate	5.3 Latency
PLIT 7	Android Activity Manager, Android Command Interpreter, Server Communication Manager , Video Stream, ALL Microcontroller Application Modules	Monitor the streaming information from the Linux command line to ensure resolution and framerate requirements are being met	Start stream with the '-Verbose' command line argument then visually confirm data transmission rates in the Linux console	Framerate and resolution targets will be met as verified by observing 3+Mb/second data transmission rate	2 - High	2 - Moderate	5.5 DataTransmission - Video Stream
PLIT 8	Android Activity Manager, Android Command Interpreter, Server Communication Manager , ALL Microcontroller Application Modules	Monitor the streaming information from the Linux command line to ensure resolution and framerate requirements are being met	Start stream with the '-Verbose' command line argument then visually confirm data transmission rates in the Linux console	Framerate and resolution targets will be met as verified by observing 3+Mb/second data transmission rate	2 - High	2 - Moderate	5.6 DataTransmission - Audio Transmission

Table 27: Processing Layer Integration Tests

4.6.1.2.3. Network Layer

Network Layer Integration Tests							
Test ID	**Modules**	**Description**	**Input**	**Expected Output/Action**	**Requirement Priority**	**Risk**	**Requirements Satisfied**
NLIT 1	ALL Web Application modules, Android Communication Manager, Microcontroller Communications Manager, Command/Message Processor	Verify that the system is able to be setup, any malfunction in the Network Layer will prevent a successful system setup	User Data	System will be setup correctly	3 - Moderate	3 - Low	5.1 System Setup
NLIT 2	Android Communication Manager, Microcontroller Communications Manager, Host Stream	Monitor the streaming information from the Linux command line to ensure resolution and framerate requirements are being met	Start stream with the '-Verbose' command line argument then visually confirm data transmission rates in the Linux console	Framerate and resolution targets will be met as verified by observing 3+Mb/second data transmission rate	2 - High	2 - Moderate	5.14 Photo/Video Resolution
NLIT 3	Android Communication Manager, Microcontroller Communications Manager, Host Stream	Monitor the streaming information from the Linux command line to ensure resolution and framerate requirements are being met	Start stream with the '-Verbose' command line argument then visually confirm data transmission rates in the Linux console	Framerate and resolution targets will be met as verified by observing 3+Mb/second data transmission rate	2 - High	2 - Moderate	5.6 DataTransmission - Audio Transmission
NLIT 4	ALL modules in Network Layer	Verify that all software is open source by verifying that the GNU license is attached to the software distribution	GNU License	Software will be found to be open source	1 - Critical	3 - Low	3.13 Open Source, 7.3 Open Source
NLIT 5	ALL Web Application modules, Android Communication Manager, Microcontroller Communications Manager, Command/Message Processor	Verify that the Account is able to be setup, any malfunction in the Network Layer will prevent a successful system setup	User Data	Account will be setup correctly	3 - Moderate	3 - Low	3.15 - Account Setup
NLIT 6	ALL Web Application modules, Android Communication Manager, Microcontroller Communications Manager, Command/Message Processor, Log Videos/Actions	Download a video through the Website in order to verify that the video log is available	User Input to website	Video will be downloaded	4 - Low	3 - Low	3.16 - Video Log Downloads
NLIT 7	ALL modules in Network Layer	Insure that the system availability exceeds 95%	Record the uptime of the microcontroller during a one week period and calculate the percent availability	Availability should be above 95% up-time	2 - High	3 - Low	5.15 - System Availability
NLIT 8	Android Communication Manager, Microcontroller Communications Manager, Command/Message Processor	Turn on Smart Door Prototype and verify that the system is available within five minutes	User plus in Smart Door Prototype	System will be available within five minutes	1 - Critical	3 - Low	5.17 Initialization Time

Table 28: Network Layer Integration Tests

4.6.1.2.4. Data Storage Layer

Data Storage Layer Integration Tests							
Test ID	Module	Description	Input	Expected Output/Action	Requirement Priority	Risk	Requirements Satisfied
DSLIT 1	Store/Retrieve Microcontroller Data	Establish that the time to store a file in the module is faster than 3 seconds.	System action message	Module stores file in less than 3 second	1 - Critical	1 - High	5.4 Response Time
DSLIT 2	Microcontroller HDD	Ensure that at least 32 GB is available for storage	Inspection of SD Card's properties using Windows 7 OS to ensure adequate storage	Storage will exceed 23GBs	3 - Moderate	3 - Low	5.7 Recording Log - Log Availability
DSLIT 3	Server HDD	Ensure that at least 32 GB is available for storage	Inspection of SD Card's properties using Windows 7 OS to ensure adequate storage	Storage will exceed 23GBs	3 - Moderate	3 - Low	5.8 Recording Log - Storage Capacity
DSLIT 4	Microcontroller HDD	Download a video through the Website in order to verify that the video log is available	User Input to website	Video will be downloaded	4 - Low	3 - Low	3.16 Video Log Downloads

Table 29: Data Storage Layer Integration Tests

4.6.2.System integration

4.6.2.1. Test Assumptions

System integration testing is equivalent to the system verification testing. The test cases in the system verification tests require a fully integrated system to function correctly.

4.7.System Verification Testing

Verification testing will confirm that Always Home designed and implemented the Smart Door system in such a way that the system as a whole meets all of the system level requirements. Validation confirms that the Smart Door meets the needs of the stakeholders and will occur upon completion of the Acceptance criteria outlined in section six of this document.

4.7.1.Test Cases

Test ID	Description	Input	Expected Output/Action	Requirement Priority	Risk	Requirements Satisfied
SV1	Initiate a Call starting from a user at the door	Doorbell Press	Video/Audio stream to phone and Audio Stream to hardware	critical-1	risk 1	
SV2	Perform monitoring from Android Device	Button click	Video feed of the camera at the door	critical-1	risk 1	
SV3	View Recordings from the website	Button click	Show a list of videos of that users	critical-1	risk 3	
SV4	Answer Call on Android device	Button click	Message of either decline call or accept call to see them	critical-1	risk 1	
SV5	Unlock/lock door from Android Device	Button Click	Door state confirmation	Future-5	risk 1	
SV6	Interaction with Users from Android device and Smart Door	Video/Audio Stream	Logged video/audio stream	critical-1	risk 2	

Table 30: System Verification Tests

4.8.Acceptance Test

Each Acceptance Criteria will have a unique functional test to be carried out by a sponsor representative. Successful completion of all ten acceptance tests will constitute acceptance of the product. These tests will be specified in the Smart Door test plan.

4.8.1.Acceptance Criteria

Criteria Number	Criterion Description
9.01	Wakes and notifies upon connected doorbell being pressed
9.02	Wakes and logs the status of the connected door upon connected door opening or closing
9.03	Live video monitoring capability within the Smart Door android app
9.04	One way video communication between door and the Smart Door android app
9.05	Two way audio communication between door and Smart Door android app
9.06	Smart Door system returns to sleep mode upon completion of interaction
9.07	Video logging and ability to retrieve videos using the Smart Door web app
9.08	Smart Door system portability and ease of installation
9.09	Smart Door system does not interfere with normal operation of door
9.10	Smart Door system supports multiple Smartphones

Table 31: Acceptance Criteria

4.8.2.Test Assumptions

Acceptance testing assumes that Unit(Module) testing, Component testing, Integration testing, and System testing has been completed and passed.

Acceptance testing assumes that the door lock/unlock feature is a future requirement

4.8.3. Test Cases

Test ID	Description	Pass criteria	Fail criteria	Priority
AT1	Wakes and notifies upon connected doorbell being presed	Passes when the Smart Door Android app receives a notification or call from the doorbell being rung	Fails when there is no signal from the Smart Door to the Android App when the door bell is rung. It will also fail if	critical-1
AT2	Wakes and logs the status of the connected door upon connected door opening or closing	Passes when the Android app receives the Door State and the final door state is saved to the database after the call	Fails when the door doesn't send a state of the door, if the Android app doesn't receive a door state, or the final door	future-5
AT3	Live video monitoring capability within the Smart Door android app	Passes when the Android app allows the user to see monitoring outside the door	Fails if there is no video stream, if there is no monitoring button, or ends without the user ending it	critical-1
AT4	One way video communication between door and the Smart Door android app	Passes when there is a video stream of the Smart Door on the Android Smart door app	Fails if there is no video stream or the Android phone doesn't display a video stream	critical-1
AT5	Two way audio communication between door and Smart Door android app	Passes when the users can have a conversation through the Smart Door Android app	Fails when there is no audio on the Smart Door or Smart Door android app	critical-1
AT6	Smart Door system returns to sleep mode upon completion of interaction	Passes when the Smart Door is off after monitoring and at the end of the call	Fails if the system stays on after five minutes of an action on it.	critical-1
AT7	Video logging and ability to retrieve videos using the Smart Door web app	Passes when there is a record in the database for each video and when the website can retrieve the information from	Fails if the system does not have a record of the video or unable to retrieve the videos for a user on the	critical-1
AT8	Smart Door system portability and ease of installation	Passes when the system is contained into one box and has a manual on how to install it	Fails if the Smart Door system is in more than one compnent and does not have instructions	critical-1
AT9	Smart Door system does not interfere with normal operation of door	Passes when door is functionally as intended	Fails if the doorbell does not ring when the doorbell is rung and the key does not open the door	critical-1

Table 32: Acceptance Test Cases

5. Features To Be Tested

5.1. Overview:

This section includes the list of features that will be tested to ensure that the Smart Door System satisfies the requirements from the System Requirement Specification document. Each subsection will describe a specific requirement and how that requirement is tested.

There are three levels of risk that associated with testable features. Following are the levels of risks:

High: feature is difficult to test.
Medium: has been tested and may not work as expected.
Low: Will be implemented and work properly.

5.2. Customer Requirements:

5.2.1. Smart Phone Application Control:

5.2.1.1. Description:

This test will verify whether the system is controlled by the smartphone application installed on the user's smartphone.

5.2.1.2. Test Approach:

This test shall manually verify if the user is able to interact with the smart door system via the user's smartphone application.

5.2.1.3. Risk Level:

Low.

5.2.2. Snapshot of Guests at Door:

5.2.2.1. Description:

This test will verify whether the smart door system is able to take photo images and store them when doorbell is rung.

5.2.2.2. Test Approach:

This test shall manually verify if there is any photo image taken and store at the time the doorbell is rung.

5.2.2.3. Risk Level:

Low.

5.2.3. Keep Activities Log:

5.2.3.1. Description:

This test will verify if the activity logs are different between users.

5.2.3.2. Test Approach:

This test shall manually verify if the systems activity logs are differentiate between users when logging all interactions and activities of the system.

5.2.3.3. Risk Level:

Low.

5.2.4. Emergency Power Supply:

5.2.4.1. Description:

This test will verify the capability of the emergency power supply.

5.2.4.2. Test Approach:

This test shall manually verify if the emergency power supply is on and backup the system if there is power outage.

5.2.4.3. Risk Level:

Low.

5.2.5. Video Monitoring:

5.2.5.1. Description:

This test will verify whether the enable registered users to monitor activities via live video feed.

5.2.5.2. Test Approach:

This test shall manually verify if the system allow users to capture activities via live video streaming on their smart phones.

5.2.5.3. Risk:

Low.

5.2.6. System Portability:

5.2.6.1. Description:

This test will verify whether the system is a portable device.

5.2.6.2. Test Approach:

This test shall manually verify if the system is a portable device that the customer can take with them when they move.

5.2.6.3. Risk Level:

Medium.

5.2.7. Smart Phone Pairing

5.2.7.1. Description:

This test will verify the ability to pair user activity with a smartphone of the system.

5.2.7.2. Test Approach:

This test will manually verify the ability to pair user activity with a particular smartphone to keep logs of who interacts with the system.

5.2.7.3. Risk Level:

Low.

5.2.8. Local Storage:

5.2.8.1. Description:

This test will verify if the local storage of the device is able to store data locally.

5.2.8.2. Test Approach:

This test shall manually verify the ability to store data logs locally on the microcontroller in case network connection is lost.

5.2.8.3. Risk Level:

Low.

5.2.9. Hardware Security:

5.2.9.1. Description:

This test will verify if the case that enclosed the system is secured.

5.2.9.2. Test Approach:

This test will manually verify if the system enclosed case is durable and secured.

5.2.9.3. Risk Level:

Low.

5.2.10. Lock/Unlock:

5.2.10.1. Description:

This test will verify whether the lock and unlock feature of the system work or not.

5.2.10.2. Test Approach:

This test shall manually verify if the system is able to lock and unlock the door remotely.

5.2.10.3. Risk Level:

Medium.

5.2.11. Nonintrusive:

5.2.11.1. Description:

This test will verify whether the system interfere with normal functionalities and operations of the door.

5.2.11.2. Test Approach:

This test shall manually verify if the system interfere with functionalities and operations of the existing door and doorbell.

5.2.11.3. Risk Level:

Low.

5.2.12. Account Setup:

5.2.12.1. Description:

This test will verify whether the system is able to provide account setup capability.

5.2.12.2. Test Approach:

This test shall manually verify if the account setup feature will be able to provide account setup and responsible for pairing a smart phone to a smart door device.

5.2.12.3. Risk Level:

Low.

5.2.13. Video Log Downloads:

5.2.13.1. Description:

This test will verify if the system allow registered users to download video logs from the website interface.

5.2.13.2. Test Approach:

This test shall manually verify whether the registered users are able to pull down video logs from the system.

5.2.13.3. Risk Level:

Low.

5.3.Packaging Requirements:

5.3.1.Size:

5.3.1.1. Description:

This test will verify if the enclosed case meet the requirement size.

5.3.1.2. Test Approach:

This test shall verify if the system is enclosed in a box that is no larger than $12 \times 12 \times 4$ ($576\ inches^3$)

5.3.1.3. Risk Level:

Low.

5.3.2.Temperature Control:

5.3.2.1. Description:

This test will verify the temperature control of the enclosure.

5.3.2.2. Test Approach:

This test shall verify if the enclosure provide ventilation for heat removal.

5.3.2.3. Risk Level:

Low.

5.4.Performance Requirements:

5.4.1.Notification Time:

5.4.1.1. Description:

This test will verify that the notification time meet the performance requirement.

5.4.1.2. Test Approach:

This test shall verify that while the system is operational and connected to the internet, the system shall notify the user of guest activity in less than 30 seconds.

5.4.1.3. Risk Level:

Medium.

5.4.2. Latency:

5.4.2.1. Description:

This test will verify that the latency time meet the performance requirement.

5.4.2.2. Test Approach:

This test shall verify that the user shall have an overall user request latency of less than 10 seconds. Overall latency includes the transmission of the user request and system response time.

5.4.2.3. Risk Level:

Medium.

5.4.3. Response Time

5.4.3.1. Description:

This test will verify that the response time meet the performance requirement.

5.4.3.2. Test Approach:

This test shall verify that while the system is operating within the Active state, the system shall respond to user requests in less than 7 seconds.

5.4.3.3. Risk Level:

Medium.

5.4.4. Data Transmission – Live Video Feed:

5.4.4.1. Description:

This test will verify that the video transmission rate meet the performance requirement.

5.4.4.2. Test Approach:

This test shall verify that the system transmits video at 30 frames per second at a minimum resolution specified in requirement 5.16.

5.4.4.3. Risk Level:

Medium.

5.4.5. Data Transmission – Audio Transmission:

5.4.5.1. Description:

This test will verify that the video transmission rate meet the performance

5.4.5.2. Test Approach:

This test shall verify that the system transmit audio at a minimum of 800 bits per second.

5.4.5.3. Risk Level:

Medium.

5.4.6. Recording Log – Log Availability:

5.4.6.1. Description:

This test will verify that the availability of the recording log meet the performance requirement.

5.4.6.2. Test Approach:

This test shall verify that the logs are updated at least 5 minutes after interaction has ended.

5.4.6.3. Risk Level:

Low.

5.4.7. Emergency Backup Battery:

5.4.7.1. Description:

This test will verify the duration of the emergency backup battery.

5.4.7.2. Test Approach:

This test shall verify that the system provides an emergency backup battery that allows it to operate for at least eight hours.

5.4.7.3. Risk Level:

Low.

5.4.8. Operating Environment:

5.4.8.1. Description:

This test will verify the ability to function within the performance requirement humidity and weather range of the system.

5.4.8.2. Test Approach:

This test shall verify that the system remains operational within humidity ranges from 0% - 95%, and temperature ranges from -12°C - 70°C.

5.4.8.3. Risk Level:

Low.

5.4.9. Video/Photo Resolution:

5.4.9.1. Description:

This test will verify the photo and video resolution meet the performance requirement.

5.4.9.2. Test Approach:

This test shall verify that the system has recording capability for photo and video resolution of at least 352x240 pixels.

5.4.9.3. Risk Level:

Low.

5.4.10. System Availability:

5.4.10.1. Description:

This test will verify the availability of the system meet the performance requirement.

5.4.10.2. Test Approach:

This test shall verify that after initial configuration, the system is available at least 95% of the time that it is connected to both working 120VAC electrical power and a working internet connection.

5.4.10.3. Risk Level:

Low

5.4.11. Notification Limit:

5.4.11.1. Description:

This test will verify the amount of notification meet the performance requirement

5.4.11.2. Test Approach:

This test shall verify that the system notifies the user of doorbell rings a maximum of 3 times in a 2-minute period where rings will be processed every 30 seconds.

5.4.11.3. Risk Level:

Low.

5.4.12. Initialization Time:

5.4.12.1. Description:

This test will verify the initialization time meet the performance requirement.

5.4.12.2. Test Approach:

This test shall verify that upon device power on, the system is initialized after a period no longer than 5 minutes.

5.4.12.3. Risk Level:

Low.

5.4.13. Microphone Sensitivity:

5.4.13.1. Description:

This test will verify the microphone sensitivity ability of the system meet the performance requirement.

5.4.13.2. Test Approach:

This test shall verify that the system provides a microphone with at least -20db sensitivity to reduce ambient noise processing.

5.4.13.3. Risk Level:

Low.

6. Features Not to be Tested

6.1. Overview:

The following listed features are not to be tested since they are either verified by system design or future features. Some of these features describe the system properties of the product and do not provide any functionality. Others provide future functionalities but are not implemented in current version.

6.2. Customer Requirement:

6.2.1. Motion Sensor:

6.2.1.1. Description:

The system shall have a short-range motion sensor. The motion sensor will take a picture and upload it to the server every time the sensor is triggered.

6.2.2. Z-Wave:

6.2.2.1. Description:

The system shall be compatible with Z-Wave wireless communications protocol.

6.3. Packaging Requirement:

6.3.1. Mounting:

6.3.1.1. Description:

The product shall provide mounting brackets and screws for secure attachment of the system. The portion of the system containing the camera shall be mounted within 2 feet of the door.

6.3.2. Casing:

6.3.2.1. Description:

The system shall be enclosed in a case that shall keep its internal components secure.

6.3.3. Software Acquisition:

6.3.3.1. Description:

The system software shall be available on the Internet. Software for the PC/hardware interface shall be packaged with the product on a CD.

6.3.4. Included Components:

6.3.4.1. Description:

The product will be delivered to the end-user with the Always Home device, user manual, and mounting hardware.

6.3.5. Team Logo:

6.3.5.1. Description:

The logo will be visibly displayed on the base of the final product.

6.3.6. System Configuration:

6.3.6.1. Description:

The system's camera, doorbell, and microphone shall be collocated in a common enclosure.

6.4. Performance Requirement:

6.4.1. System Setup:

6.4.1.1. Description:

The system shall be able to be mounted and configured in less than ten minutes by the end user. The user will mount the hardware near the door, and the configuration shall be defined as pairing the user's mobile device with the hardware.

6.5. Safety Requirement:

6.5.1. Camera Mounting:

6.5.1.1. Description:

The camera shall be secured properly to prevent a fall or collision hazard. The camera's mounting base must be properly secured to the door and positioned at the correct height for use.

6.5.2. Microphone Mounting:

6.5.2.1. Description:

The microphone shall be secured properly to prevent a fall or collision hazard. The microphone's mounting base must be properly secured to a structure and positioned four or more vertical feet off the ground.

6.5.3. Camera and Microphone Weather Safety:

6.5.3.1. Description:

The camera and microphone shall be installed in a manner that is considered to be weather safe.

6.5.4. Receptacles:

6.5.4.1. Description:

All electric receptacles shall meet the National Electrical Code for outdoor wiring.

6.6. Maintenance and Support Requirements:

6.6.1. Software Updates:

6.6.1.1. Description:

Software updates shall be available from the internet.

6.6.2. User Manual:

6.6.2.1. Description:

The system shall provide English instructions on how to use and configure the device. There shall be a troubleshooting guide section for system installer.

6.6.3. Open Source:

6.6.3.1. Description:

All documents and source code shall be made available without financial remuneration. Code shall be commented and include breakpoints to support troubleshooting.

6.7. Other Requirement:

6.7.1. Web Interface Support:

6.7.1.1. Description:

The system shall include a web application that provides the same capabilities for controlling and interacting with the system as the smartphone application.

6.7.2. Portable Source Code:

6.7.2.1. Description:

The system shall include an iOS application that provides the same capabilities for controlling and interacting with the system as the smartphone application.

6.7.3. Notification Control:

6.7.3.1. Description:

The system shall not notify the customer again for at least two minutes if the user chooses to ignore the first notification.

7. Approach/Strategy

7.1. Overall Test Strategy

The test strategy for the Smart Door will ensures that both the software and the hardware operate to fulfill the requirement set by the team and stakeholders. The team will test the hardware to make sure that all the components operate correctly individually, and can be integrated correctly. The hardware will also be tested to ensure that the hardware will allow software to meeting its functionality. The work flow for the testing the software will be done in tiers because the team will be testing the system from the ground up. For each function there will be a unit tests done, and if the test is successful then integration testing will be done for the module that it belongs to. If a module is complete and passes the integration and unit testing then there will be component testing done to the module. Once the modules are all complete they will also be unit tested and then if successful then integration testing will be done to the subsystem it belongs to. Acceptance testing will then be done to ensure that the system is complete and meets all the requirements.

7.2. Configurations tested/not tested

Only the priority one through four hardware and software configurations will be tested and priority five future configurations will not be tested.

7.3.Plan to deal with defects identified

In order to effectively manage and correct bugs the team will document the follow characteristics in a bug tracking system when a bug is encountered.

1. The time the bug was found.
2. A Description of the bug.
3. How to reproduce the bug.
4. Which components are affected by the bug.
5. Severity of the bug.
6. Name of the person who found the bug.

Once a bug has been fixed the person who fixed the bug must document the following in the close out report.

1. The time the bug was fixed.
2. How the bug was fixed.
3. Success or failure of bug fix.

7.4. Metrics

The testing metrics used will follow the requirement priority defined in the SRS. The modules that satisfy multiple requirements will be assigned the priority of the highest requirement in the array of requirements.

Priority 1 – Critical
Critical priority items will severely impact the product, and render it useless

Priority 2 – High
High priority items will greatly impact the usability of the product, and render it almost obsolete.

Priority 3 – Moderate
Moderate priority items will impact the usability of the product, but will still be usable.

Priority 4 – Low
Low priority items will not impact the usability of the product, but will make some task tedious.

Priority 5 – Future
Future priority items will only enhance the usability of the product.

7.5.Special Requirements for Testing

- ASP.NET Unit Test– for unit testing the functions modules and subsystems.
- Java Development Tools JUnit - for unit testing the functions modules and subsystems.
- Thermometer – for testing hardware heating.

- Ruler – for testing the size constraint.
- Timer – for testing the system latency.

7.6.Scheduling

7.6.1.Schedule

Preliminary testing during development so that each component is ready for integration ASAP after development

7.6.2.Detailed schedule

See section nine of this document.

7.7.Feasibility

This is similar to the requirements analysis and review, except this focuses on our team's ability to meet project requirements. If the team is unable to deliver a product that meets its specifications then we will need to determine how feasible the feature is that is not meeting requirements. This is a combination of Risk Management, but requires a QMP for qualitative and quantitative analysis.1

8. Test Deliverables

8.1.Test Plan

The Test Plan describes all aspects of our testing program. The plan will include our approach, test requirements, test data and schedule.

8.2.Test Cases

Test Cases are included in the test plan. These are the actual process, input, and expected output for each test that we will perform.

8.3.Test Log

The Test Log is a table used during testing to record the results of each test. It will include the test ID number, testing personnel, expected result, actual result, Pass/Fail, and Comments for each test.

8.3.1. Example Test Log

Test ID#	Testing Personnel	Expected Result	Actual Result	Pass/Fail	Comments
Sample 1	Jon Doe	Lorem	Ipsum	Fail	Bacon ipsum dolor sit amet short loin prosciutto bacon, sausage beef ribs venison boudin biltong.
Sample 2	Don Joe	Lorem	Lorem	Pass	Wafer gummi bears donut marshmallow chocolate bar soufflé oat cake.
Sample 3	Sally Sample	Ipsum	Ipsum	Pass	What you have to ask yourself is, do i feel lucky. well do ya' punk?
Sample 4	Jane Doe	Ipsum	Lorem	Fail	you measure yourself by the people who measure themselves by you. let me tell you something my friend. hope is a dangerous
Sample 5	Dane Joe	Lorem	Lorem	Pass	Lorizzle ipsizzle dolor izzle amizzle, consectetuer adipiscing pizzle. Get down get down fo shizzle mah

Table 33: Example Test Log

8.4. Test Report

The Test Report is a summarization of the testing effort after it has been completed. This report will include the overall success or failure of the program, the pass/fail results of each test and any interesting problems from the Test Log.

9. Test Schedule

9.1.Description

9.2.Schedule

Task Number	Task Name	Predecessors	Resource Names	Planned Start	Actual Start	Planned Finish
2.1.4.3.1	Unit Test	N/A	Team	Mon 3/24/14	N/A	Thu 3/27/14
2.1.4.3.2	Component Test UI		Team	Thu 3/27/14	N/A	Sun 3/30/14
2.1.4.3.3	Component Test Application	2.1.4.3.1	Team	Sun 3/30/14	N/A	Wed 4/2/14
2.1.4.3.4	Componnent Test Server	2.1.4.3.1	Team	Wed 4/2/14	N/A	Sat 4/5/14
2.1.4.3.5	Component Test Storage	2.1.4.3.1	Team	Sat 4/5/14	N/A	Tue 4/8/14
2.1.4.3.6	Module Integration Test	2.1.4.3.3 2.1.4.3.4 2.1.4.3.5	Team	Tue 4/8/14	N/A	Thu 4/10/14
2.1.4.3.7	Subsystem Integration	2.1.4.3.6	Team	Thu 4/10/14	N/A	Sat 4/12/14
2.1.4.3.8	Layer Intergration Test	2.1.4.3.7	Team	Sat 4/12/14	N/A	Mon 4/14/14
2.1.4.3.9	System Integration Test	2.1.4.3.8	Team	Mon 4/14/14	N/A	Wed 4/16/14
2.1.4.3.10	System Test	2.1.4.3.9	Team	Wed 4/16/14	N/A	Thu 4/17/14
2.1.4.3.11	Acceptance Test	2.1.4.3.11	All Stakeholders	Thu 4/17/14	N/A	Fri 4/18/14

Table 34: Testing Schedule

10. Approvals

Name	Role	Signature	Date
Mike O'dell	Project Manager		
Sean Jones	Sponsor Repreasentative		
James Lunsford	Lead Developer		
Juan Duarte	Android Design Lead		
Khuong Nguyen	Web Design Lead		
Jay Otterbine	Software Engineering Lead		

Table 35: Approvals